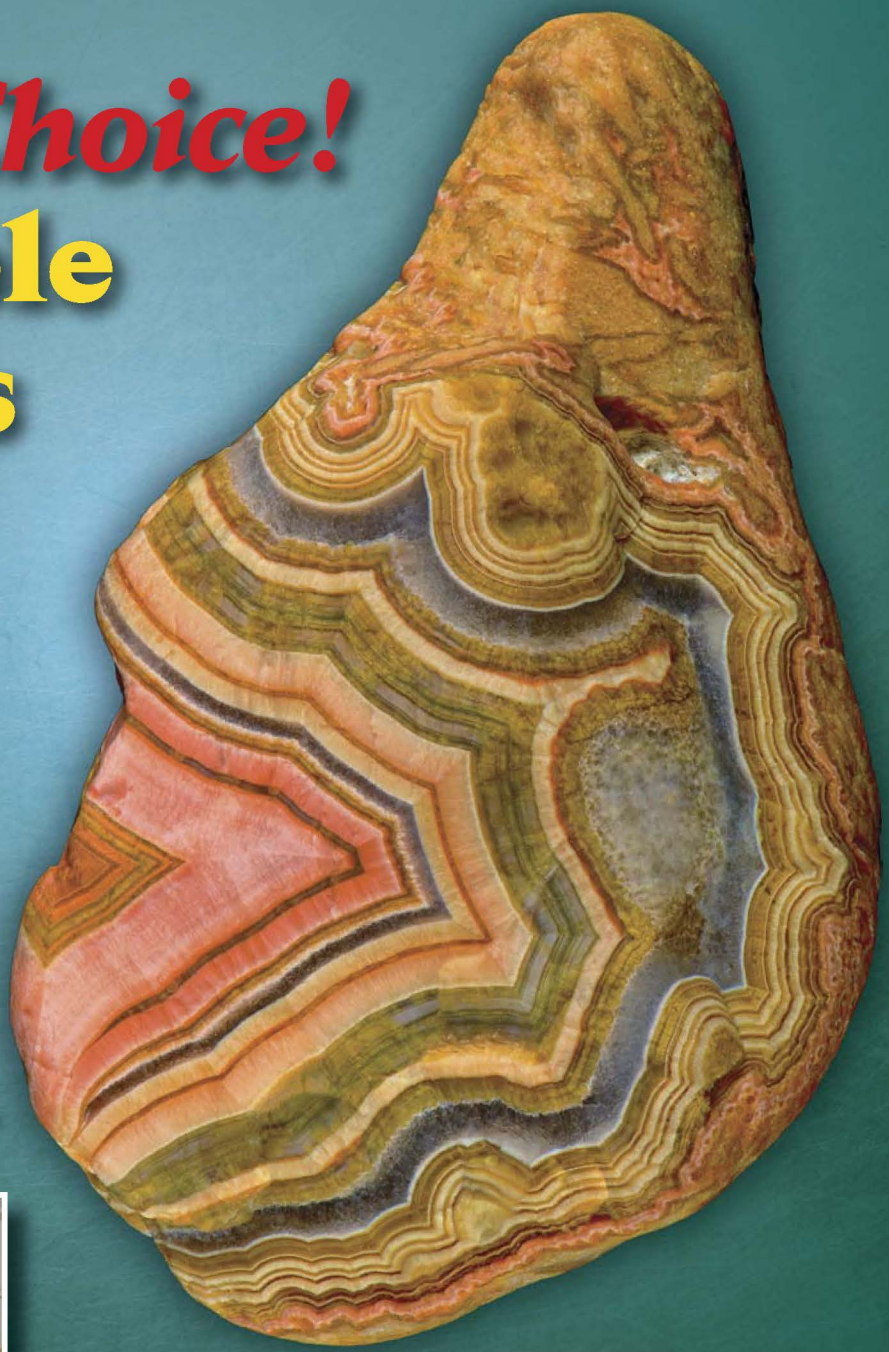
AUGUST 2015

# Rock&Gem

THE EARTH'S TREASURES · MINERALS AND JEWELRY

VOL. 45 ISSUE 08

## Editor's Choice! Collectible Favorites



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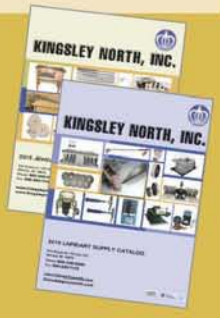

Rock&Gem
Volume 45, Number 08 August 2015

## ON THE COVER

This fine Fairburn agate (1.7 inches by 1.5 inches) with Skittles® colors exhibits everything a collector looks for in a specimen from South Dakota. (Tom Shearer photo/Mikelene Reusse specimen)

# FEATURES



# FIELD TRIP



## REGULAR COLUMNS



**12**

**18**

**46**

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# FIELD NOTES

## READER LETTERS

### ID Assistance

I have been subscribing to *Rock & Gem* for some time, and notice in Field Notes you sometimes help readers solve problems.

I have found a specimen that I have not been able to identify and am wondering if any of your readers know what it is. Two different specimens are pictured. There is druzy quartz covering much of them.

I know nothing of their origins. I purchased them at an estate sale and no one knew anything about them.

—Sue (Barbara) Hazelden
sujagems1@aol.com

### Lovely, Lowly Zincite

I've subscribed to your magazine for over 20 years now and love it. I really can't wait to read Bob Jones' articles every month.

I have three lovely zincite specimens: one orange/yellow, one purple/green, and one green. Every time I ask dealers at the shows about them, they kinda look down on zincite. I know they are sort of manmade, but they are some of my favorites in my collection of more than 1,000 rocks and minerals. I'm just wondering if Bob has ever done an article on zincite.

—Eddie Corrin
via e-mail

Thanks for your kind comments about my articles. As for zincite, what you have is manmade, from a smelter where zinc minerals are processed. As the zinc reaches the melting point, some of it vaporizes and goes up the flue, combining with oxygen to form the zincite. The gas converts directly to a solid, namely the crystals you have. It cools enough to encrust the equipment, chimney, etc., a process called sublimation. The odd colors are due to trace metals that get into the formation.

I hope you have used a UV light on your pieces; they fluoresce brilliantly, unlike natural zincite.

—Bob Jones

### Time Typo

In the May 2015 article titled "The Hartman Rock Garden" the last sentence states, "The garden, located at 1905 Russell Ave., is open 365 days a year, from *dusk to dawn*, and welcomes visitors at no cost." I wonder if that should be *dawn to dusk*?

—Barbara Sky
via e-mail

Nice catch, Barbara.

—Editor

MINDY COOPER PHOTO

### Silver Reef Side Note

For a small museum, the Silver Reef Museum [see "Silver Reef, Utah", by Steve Voynick, June 2015] has a top-notch staff of knowledgeable docents. Those wanting a more in-depth history of the area can refer to "Geology of the Silver Reef (Harrisburg) Mining District", by Paul Dean Proctor, which was published by the Utah Geological and Mineralogical Survey in April 1953. Keep in mind that this survey was done during the uranium-mining era.

While in St. George, you should go down to the Dinosaur Discovery Site museum on East Riverside Drive. It is well worth the visit.

—Richard Gibbons
St. George, UT

Send comments to editor@rockngem.com or to Field Notes, *Rock & Gem* magazine, 5235 Mission Oaks Blvd. #201, Camarillo, CA 93012. All submissions are subject to editing for content and length.


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# LAPIDARY OF THE MONTH

AUGUST 2015

I've always been a bit of a rockhound, growing up on a farm in the foothills of North Carolina. Beautiful rocks were plentiful in plowed fields after the rain. I always wanted to make jewelry, but just didn't know where to begin. Recently, I took some jewelry classes to learn more about metalworking. (I'm a plating chemist in my day job.)

I bought an 83-gram slab of orange alabaster online because I thought it might be easy to carve. I studied the piece and tried to imagine what shape I could draw on it that would also work with the size of my rotary tool bits. I picked an eagle picture I believed could easily be made into a motif.

I used photo-editing software to clean out any background and convert the eagle picture into an outline. I printed the final motif to scale so it would fit over my alabaster slab. I used glue to hold the print on the slab and used a diamond bit with a rotary tool (no water) to engrave the outlines into the slab. From there, I could cut the eagle shape all the way through the slab. I used sandpaper up to 3,000 grit to smooth the eagle's edges and surfaces.

I cleaned it with acetone, then polished with Tung oil and carnauba wax.

Since alabaster is relatively soft, I wanted to put a solid-metal backing on it to protect it. I used a 22 gauge sheet of jeweler's brass. To get the eagle to fit, I scanned it 1:1 on my scanner, then printed the scanned image and glued it to the sheet metal. Then I cut out the brass eagle with a jeweler's saw and #2 blade.

I stenciled my artist signature onto the metal and cut it out. I used 16 gauge solid brass wire to make prongs and silver solder and a butane torch to put the prongs on. I textured the metal with a beat-up forging hammer, which also kept the metal flat while working on it.

I used a brass-antiquing solution to darken the metal and buffed out some highlights. I decided that, since the alabaster was a little translucent, this would bring out some of the details more. Also, antiquing covered some of the mistakes I made as a beginner.

I soldered some coiled wire to the back to hold a leather tie like a bolo. I also made matching aglets with the brass wire and some solid brass beads. I buffed the metal with Tung oil also, because it dries like a lacquer.

I was concerned about scratching my polished alabaster, so I whittled my own prong-pushing tool from a soft plum tree twig. I carved the shape of the wire into the twig so it would cap over and push the wire firmly without scuffing the alabaster.

*—Tammy Jo Jones*
Advance, NC


**Would you like to be named Lapidary of the Month?**

To enter the contest:

- Write a 500-word step-by-step description of how you crafted your lapidary project from start to finish. Save it as a document file.
- Take at least one sharp, close-up, color digital photo of the finished project. Photos must be high-resolution (300 dpi at 4 inches by 5 inches, minimum).
- Attach your document file and digital photo (.tif or .jpg) to an e-mail and send it to editor@rockngem.com with the subject line "Lapidary of the Month".
- Make sure you include your name and street address (not a PO Box) for prize delivery should your entry be selected for publication. Only winners will be notified. E-mail the editor or call (972) 448-4626 with any questions about these requirements.

Lapidary of the Month winners receive a two-speed Dremel Model 200 N/40 MultiPro kit and a wall plaque in recognition of their creativity and craftsmanship. Winning projects are also posted on our Web site, www.rockngem.com.

Mark Your Calendar!

# SHOW DATES

Submit show date information at least four months in advance using the electronic form at www.rockngem.com.

## August 2015

**1-1—ISHPEMING, MI, MICHIGAN:** Annual show; Ishpeming Rock and Mineral Club, Ishpeming Elks Club; 597 Lake Shore Dr. ; Sat. 9:30 am-4:30 pm; Admission is Free; 2014 show information AUGUST 2nd, Ishpeming, Michigan: Ishpeming Rock and Mineral Clubs 39th Annual Gem and Mineral Show, Ishpeming Elks Club, 597 lake Shore Dr.; Saturday 9:30-4:30; Free admission; kids' area, silent auction, hourly prizes, raffle, demonstrations, dealers; Cracker Barrel session Saturday evening at 7pm; live mineral auction, raffle, program; Mineral field trips Fri., Aug 1, and Sun., Aug 3; Contact Ernest Johnson, 1962 W. Fair, Marquette, MI 49855, 906-228-9422; e-mail; ejohnson@nmu.edu Ernest Johnson, Show Chairperson Ishpeming Rock and Mineral Club 1962 W. Fair Marquette, MI 49855 906-228-9422 ejohnson@nmu.edu ; contact Ernest Johnson, 1962 W. Fair, Marquette, MI 49855, (906) 228-9422; e-mail: ejohnson@nmu.edu; Web site: www.ishpemingrocks.org

**7-9—WEST SPRINGFIELD, MASSACHUSETTS:** Wholesale and retail show; Martin Zinn Expositions, L.L.C., Eastern States Exposition - Better Living Center; 1305 Memorial Dr.; Fri. 10:00 am-6:00 pm, Sat. 10:00 am-6:00 pm, Sun. 10:00 am-5:00 pm; Adults $6.00, Children are Free!; Huge air-conditioned hall with over 200 vendors in retail and wholesale (registration required) sections. Free lectures by popular speakers, free mineral identification, free mineral samples for all kids, and hourly door prize drawings. Also available for a small fee are sluice-panning for gems or fossils, and geode cracking. Fine minerals, fossils, gems, jewelry, beads, meteorites, lapidary supplies and decorator items in all price ranges.; contact Regina Aumente, PO Box 665, Bernalillo, NM 87004, (505) 867-0425; e-mail: mzexpos@gmail.com; Web site: http://www.mzexpos.com/east_coast.html

**7-9—HOUGHTON, MICHIGAN:** Annual show; Copper Country Rock and Mineral Club, Houghton Elementary School; 203 W Jacker Street , (Corner of Bridge and Jackson Streets); Fri. 1:00 pm-8:00 pm, Sat. 10:00 am-6:00 pm, Sun. 11:00 am-3:00 pm; Admission is Free; Past events have included geode cracking and metal detector use for children.; contact Norm Gruber, (906) 228-6764; e-mail: pres@ccrmc.info

**7-9—PLEASANTON, CALIFORNIA:** Wholesale and retail show; Gem Faire Inc, Alameda County Fairgrounds; 4501 Pleasanton Ave; Fri. Noon-6 pm, Sat. 10am-6 pm, Sun. 10 am-5 pm; Students, Adults + Seniors $7, Children ages 0-11 are free!; Fine jewelry, precious & semi-precious gemstones, millions of beads, crystals, gold & silver, minerals & much more at manufacturer's prices. Exhibitors from around the world. Jewelry repair & cleaning while you shop. Free hourly door prizes. ; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: http://www.gemfaire.com

**8-9—RICE LAKE , WISCONSIN:** Annual show; Northwest Wisconsin Gem & Mineral Society, Barron County Fair Grounds; Hwy. 48 North; Sat. 10:00 am-5:00 pm; Admission is Free!; Gems, jewelry, beads, minerals, fossils, rocks, lapidary equipment and supplies, jewelry-making and wire wrapping demonstrators, polished rocks, geodes, crystals. ; contact Roy Wickman, 1127 7th St, Almena, WI 54805; e-mail: rktswick@chibardun.net

**8-9—EDMONDS, WASHINGTON:** August Sale; Maplewood Rock and Gem Club, Maplewood Rock and Gem Clubhouse; 8802 196th St; Sat. 9 am-5 pm, Sun. 10 am-5 pm; Admission is Free; vendors welcome; contact Bev Ryder, (425) 338-4184; e-mail: famryd@aol.com

**8-9—WALNUT CREEK, CALIFORNIA:** Show and sale; Pacific Crystai Guild, Civic Park Community Center; 1371 Civic Drive; Sat. 10:00 am-6:00 pm; Adults $8, Children are Free!; Get ready for THE SUMMER CONTRA COSTA CRYSTAL FAIR which includes a magical mix of crystals, minerals, beads, and jewelry. Whether it's stone beads from Nepal, amethyst geodes from Madagascar, jade from China, or jewelry from northern California artisans –you'll find it at the Crystal Fair at below market prices. You'll also find an aura camera, tarot reader, sound healer, massage therapist, reiki master and many others – 30 booths in all. The exact location is the Civic Park Community Center at 1375 Civic Drive at Broadway in Walnut Creek. The hours are 10am to 6pm on Saturday, August 8; and 10 am to 4 pm on Sunday, August 9. Admission is $8 (under 12 free). There is plenty of free parking and the downtown Walnut Creek BART station has a shuttle to Civic Park. For info: Jerry Tomlinson

*continued on page 24*

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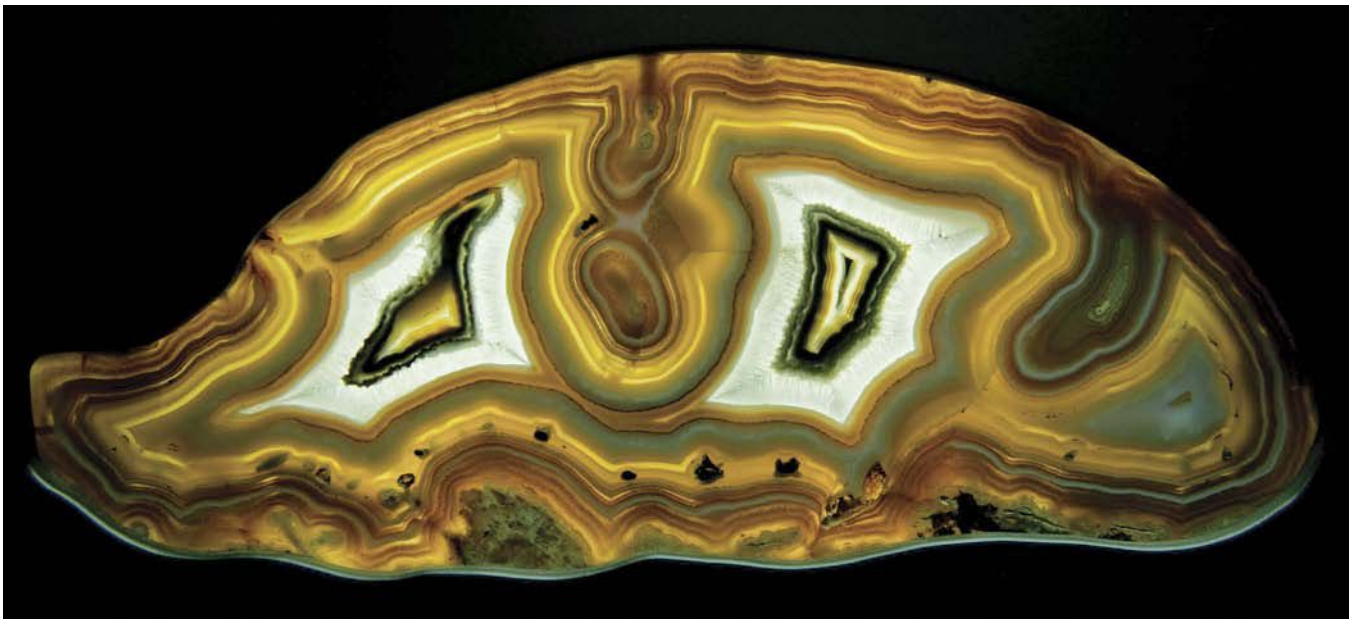
# My Favorite Minerals



HANNES GROBE VIA WIKIMEDIA COMMONS

**Fortification agates are the best-known type, and Minas Gerais, Brasil, is one of the most famous sources. (Senckenberg Naturmuseum, Frankfurt, Germany)**

## PART II: Massive Quartz and Crystallized Copper Species

Story by Bob Jones

In contrast to the crystallized minerals I lauded in Part I—epidote, rhodochrosite and bournonite—my next four favorites are a massive form of quartz and three copper species: azurite, malachite and cuprite.

**AGATE**

Agate comes in as many forms as nature's creativity can imagine. The classic fortification agate, a banded nodule of varied color, is the best known form, but there are countless other types that are just as colorful, just as attractive, and actually more accessible, since fortification agate localities are pretty well depleted or are under claim.

When you get involved with agates, you must necessarily get involved in the many discussions of how agates form. Theories abound about agate formation, most particularly the banded fortification agates we find so attractive. One school of thought holds that fortification agates formed from silica gel colloids during the eruption of viscous lava. Other ideas focus on the infusion of hot, metal-rich solutions that enter amygdules, or gas cavities, after the lava has solidified. These hot solutions are always present in volcanic regions and often surge to the surface as hot springs. Whichever theory is current should not affect your attitude toward collecting agates. It is the inherent beauty and uniqueness of each agate that should be your guiding ideal.

Agates have been a favorite decorative stone for millennia—and no wonder, since they are so colorful and beautifully patterned. The word agate comes from the name of the river Achates in Sicily, where agates were found, but they were known of long before that discovery. Worked agate pieces have been found that are over 5,000 years old. This is all the more reason to admire this cryptocrystalline form of quartz.

Historically, the most important agate field was in the Idar-Oberstein area of Germany. Agate mining there dates back to pre-Roman times. The stones were distributed throughout Europe and the Near East. The Greeks and Romans both created marvelous objects using Idar agates. The exciting thing about this is that the Idar-Oberstein agate area is still active. It is possible to take an underground tour of the old agate mines here and see agates still embedded in the exposed lava. And if you feel up to it, you can actually pay a fee and collect agates in the area.

Today, the supply of agates is better than ever, thanks to amateur rockhounds who have discovered sources for agate and related, colorful jasper. Argentina has become a major source thanks to rockhounds who have developed fields there. Most agate and jasper sources in America have been discovered thanks to rockhounds. Federal land was wide open when rockhounding grew after World War II. Countless sites were found and worked successfully. Today, many of these are closed by the government or have been claimed by individuals who seek to profit

PARENT GERY VIA WIKIMEDIA COMMONS

**Deep-red crystals of cuprite combine with crystals of kolwezite and dolomite in this specimen from the Republic of Congo. (Mashamba West mine, Kolwezi District)**

PARENT GERY VIA WIKIMEDIA COMMONS

**China is a more recent source of crystallized azurite specimens, which bear a striking likeness to the specimens from Bisbee, Arizona.**

from agate and jasper mining. This means the supply—though it may seem finite—continues to meet the demand of the lapidary community.

I first admired and developed an interest in agates when I saw the collection of mineral dealer Jim Mueller of Phoenix, Arizona. His father had been one of the earliest collectors of Mexican agates, from the Chihuahua Desert, before World War II. A selection of his Mexican agates were sliced in half and polished. The result was an amazing array of colorful, banded agates any collector would be proud to own. Gradually, the Mexican agate fields were fairly well depleted or closed by ranch owners, and the supply of agates from Mexico pretty well dried up. Today, some mining has resumed, with success.

I am of the opinion that every mineral collection should have several varieties of agate, for they are as important and as beautiful as crystallized minerals. The interior decorators of yesteryear realized this, and all kinds of agate are inlaid in table tops, chests, walls, and the like. The stately homes of England and Europe, for example, may boast some crystallized minerals, but agate is the stone that dominates their interior décor.

Today, we are fortunate that superb agates can still be found in Australia, Argentina and Mexico. Rockhounds still delight in collecting agates and jaspers of all forms, colors, images and shapes. If you collect only crystallized mineral specimens, you have missed out on a huge segment of nature's mineral beauty.

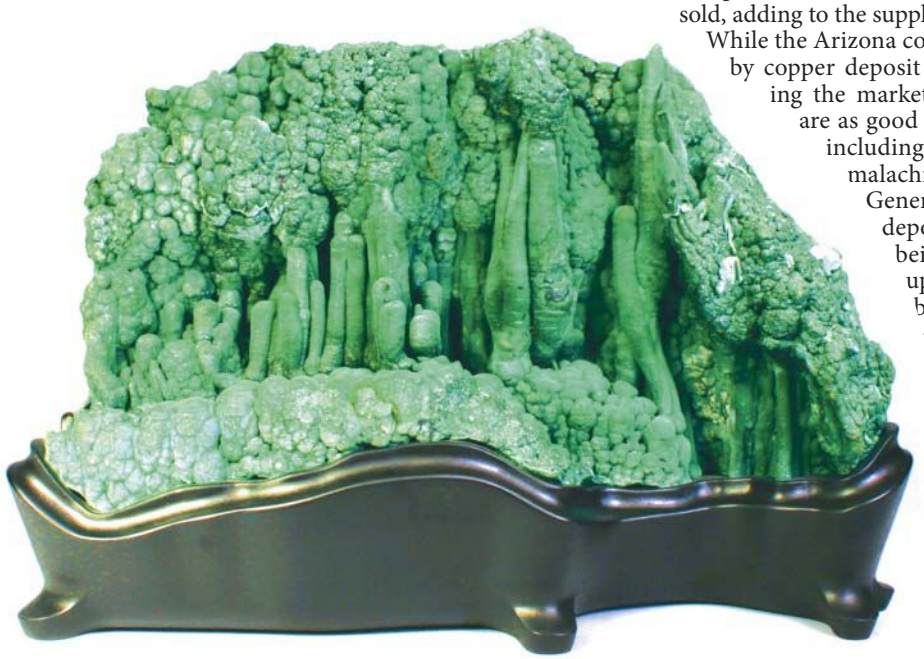
## AZURITE AND MALACHITE

I live in Arizona, the Copper State. For nearly 150 years, Arizona has been a cornucopia of copper species. The mine at Ajo was found thanks to "copper bloom", bright-green stains on the country rock. Jerome, north of Phoenix, was discovered by the Spanish, and in the 1800s, it proved to be an extremely rich copper deposit. But it remained for the Morenci and Bisbee mines to open the eyes of the world to the copper riches of Arizona. If you are an active rockhound in this state, you inevitably collect azurite, malachite, cuprite, and several hundred other copper species.

The mines of Bisbee were opened around 1880, just after Morenci began producing fine specimens. In desert deposits like these, weathering can penetrate the earth to well over 1,000 feet. This produces secondary copper species, including our subject beauties: azurite, malachite and cuprite. The management at these mines did not frown on miners helping themselves to specimens, as long as they did their work. The result is that a huge supply of these minerals came onto the market as Bisbee miners' families amassed collections. Through the ensuing decades, especially after the mines of Bisbee closed in the 1950s, these collections slowly and steadily found their way into the marketplace.

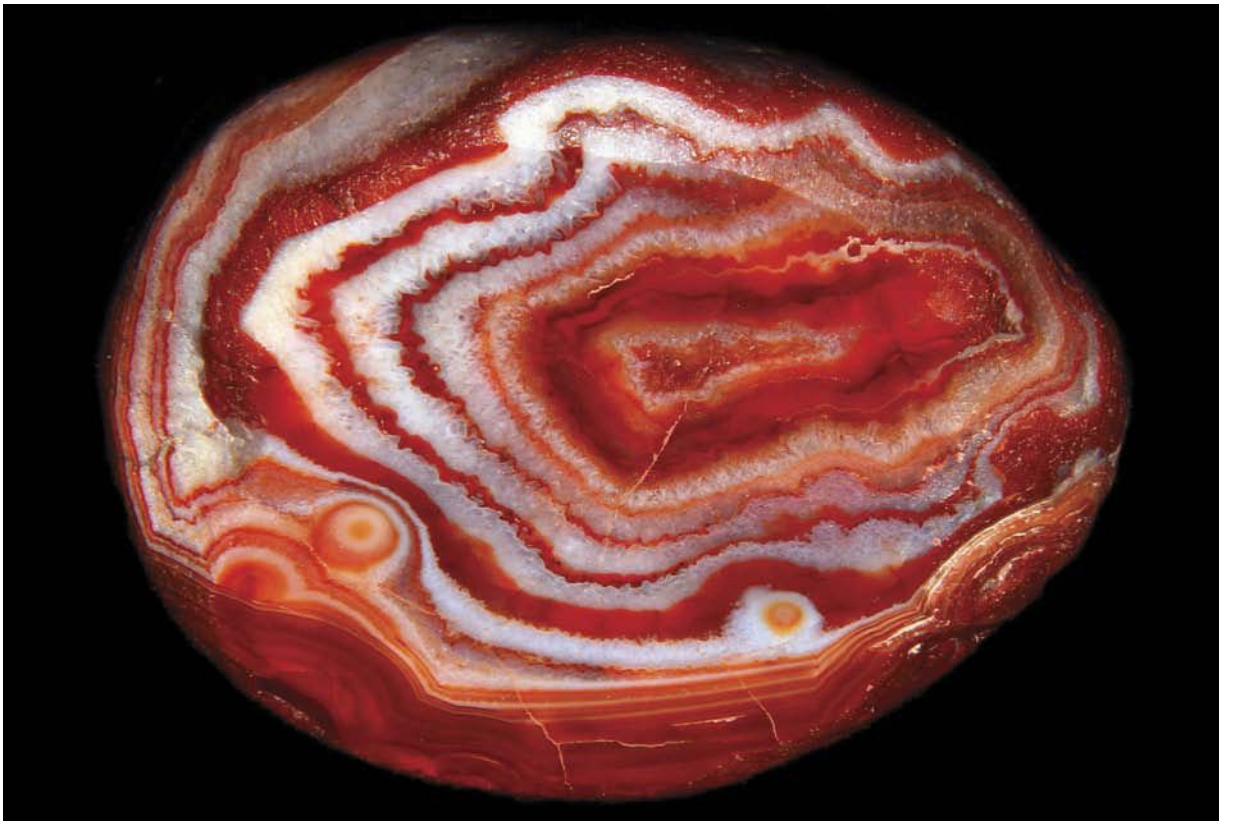
Joining the gradual influx of Arizona copper specimens from old, private collections are museum pieces. Museums are traditionally short of funds, and when there are quantities of a particular species in a museum collection, some can be traded or even sold, adding to the supply available.

While the Arizona copper mines are silent these days, a nearby copper deposit in Sonora, Mexico, is currently flooding the market with amazing azurite specimens that are as good as those from any other azurite source, including Bisbee and Tsumeb, Namibia. Choice malachite pseudomorphs occur there, as well. Generally known as Milpillas, Sonora, this deposit was opened in the 1990s and is still being worked. Though the majority of the upper oxide zone sources of azurite have been mined out, an occasional rich pocket of electric blue azurite is encountered. No wonder I find azurite one of my favorite species.



LARRY AND NINA RAGLE PHOTO

**This marvelous malachite from the huge copper belt in the Congo is a fine example of the malachite from the region. (R. Johnson collection)**



LECH DARSKI VIA WIKIMEDIA COMMONS

**Crystalline and massive silica combine in this vibrant Lake Superior agate from Duluth, Minnesota.**

Azurite's almost constant companion is lovely malachite. While azurite, a blue mineral, is found in a variety of superb crystal forms, malachite, its green cousin, almost never develops large crystals. There are specimens of crystallized malachite labeled "primary", but that is more an acknowledgement of the small individual crystals than anything else.

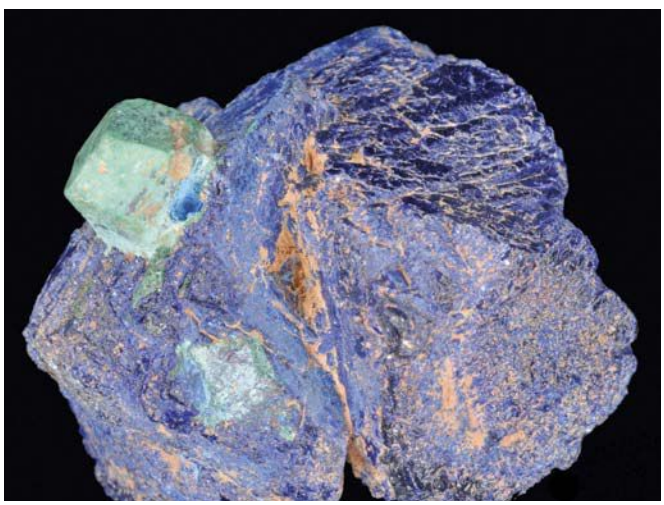
The common form of malachite is a velvety mass made up of hairlike crystals in tight bundles that completely cover the piece. Those same microcrystals can also develop small, radiating microcrystals that form spherules. Because they grow tightly together, they give the malachite a wonderful, lumpy surface that we say is botryoidal, or reniform.

The interesting thing about azurite and malachite is that the latter very often replaces azurite to form wonderful pseudomorphs. They have the crystal form of azurite, but the color of malachite. The finest example of this is an azurite crystal that is partly blue and partly green. The finest of these is a fine, blue azurite crystal in which a very lovely radiating rosette of malachite has developed.

Chemically, azurite and malachite are very close in composition. Azurite is made up of three copper atoms joined with two carbonate radicals and three hydroxyl radicals [$Cu_3(CO_3)_2(OH)_2$]. Malachite is made up of two copper atoms with just one carbonate radical and one hydroxyl radical [$Cu_2CO_3(OH)_2$]. Malachite seems more than willing to replace azurite, but how come you never see azurite pseudomorphs after malachite? The answer lies in changing conditions after the malachite forms.

Azurite crystals form underground from a solution that may be slightly lacking in oxygen energy. Later, surface waters that penetrate into azurite's environment bring more oxygen energy, which encourages the development of malachite replacing azurite. So why isn't the malachite pseudomorph also blue? Note that the original azurite molecule held three copper ions, but malachite's has one. Some of those copper ions, once freed, become chromophores affecting the mineral's color.

This remarkable chemical change between azurite and malachite is illustrated in paintings done in Europe 200 years ago. At that time, the copper deposits at Chessy, France, was mainly producing chalcopyrite, and the azurite found there was used as paint pigment, mainly by Italian artists, who liked its intense blue color. It was common practice to use the blue pigment in oil-based paintings, particularly for the broad sweep of a sky. You can guess what happened over time. The lovely blue slowly changed to green because of exposure to a moist atmosphere.



PARENT GERY VIA WIKIMEDIA COMMONS

**The classic locality of Chessy, France, produced wonderful cuprite octahedrons that are coated with, and partially replaced by, malachite.**

## CUPRITE

As beautiful and delightful as azurite and malachite are, my favorite copper species is cuprite, a simple copper oxide ($Cu_2O$). It is any one of several shades of red, from intense cherry red to a rich, dark, metallic red. The surfaces of cuprite crystals often show a metallic sheen due to surface oxidation.

STEVE DECKER PHOTO

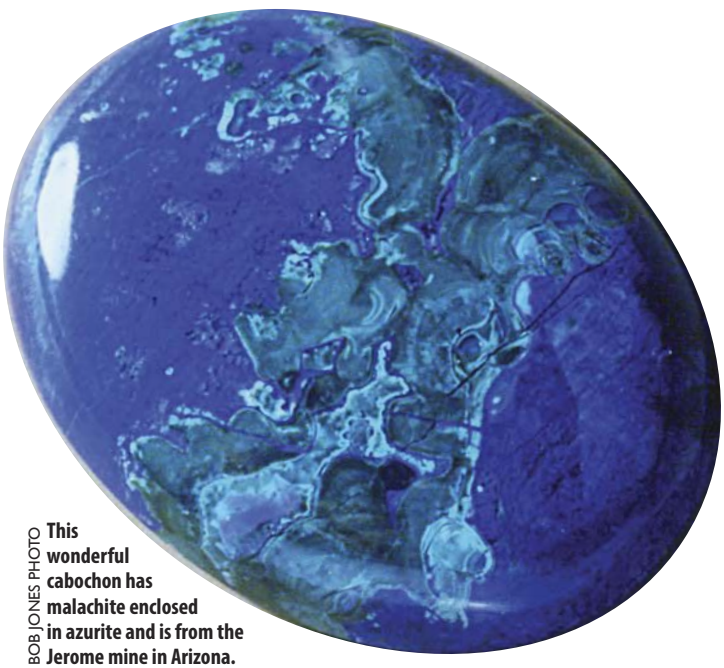
▲ This fine crystallized cuprite comes from Tsumeb, Namibia.

ROB LAVINSKY PHOTO

◥ This pseudomorph specimen features spheroidal rosettes of azurite that have been totally replaced by rich green malachite and smaller botryoids of light-green "primary" malachite. (Seabra, Bahia, Brazil)

ROB LAVINSKY PHOTO

▶ Specimens from older collections, such as this Idaho azurite rosette from the collection of William S. Vaux (1811-82), sometimes return to the collector market. (Philadelphia Academy of Natural Sciences collection)



BOB JONES PHOTO

This wonderful cabochon has malachite enclosed in azurite and is from the Jerome mine in Arizona.

The mineral forms simple cubes that range in size from microscopic to an inch or so. One gemmy beauty is 2 inches along one edge. This amazing crystal was actually dug by amateur miners, friends of mine who knew their way around underground in Bisbee.

Simple cuprite cubes are not as common as octahedrons and dodecahedrons. One unusual form of cuprite is even given a special name, chalcotrichite. It forms from cuprite that grew very rapidly in one direction while maintaining narrow dimensions in the other two. The result is often an orderly mat of red hairs that shows the cubic pattern of cuprite, like the wires in a window screen.

It can also develop in a clutch of red hairs shooting off in all directions, creating a disordered tangle. My favorite is what is often called "tile ore". The cuprite has formed in a lustrous, flat mat showing a perfect cubic pattern like floor tiles, hence the nickname.

Classic cuprite includes the lovely, small octahedrons from Chessy, whose supply has long since been exhausted. These perfect cuprite crystals are very often coated with, and sometimes replaced by, malachite. Another classic—this time a modern one—has come from a now-closed copper mine in Onganja, Namibia. These dodecahedrons were found in singles and small groups of several intergrown crystals reaching a couple of inches across. Coated with malachite, these gem beauties could be faceted into large, dark-red gems.

Arizona has been the main source of cuprite, though the copper oxide has come from hundreds of mines and just about every country. Bisbee is famous for its cuprite crystal forms. My favorite source is actually Ray, Arizona, where in the 1950s, during the excavation of the Pearl Handle Pit, miners encountered thousands of copper wire groups coated with bright-red, crystallized cuprite. The copper wires reach 6 inches in length and occur in branching clusters. These spidery clusters are extremely attractive.

Thanks to the intricate patterns, vibrant colors, and unusual crystal habits are why everyone should have examples of these four minerals in their collection. You can see why agate, malachite, azurite and cuprite have ended up on my favorite list.

*Part III will describe smithsonite, cerussite, legrandite, and my most favorite mineral, wulfenite.*

# BENCH TIPS

by BOB RUSH

## Do You Dop?

When I learned lapidary techniques many decades ago, I wasn't taught to use a dop to hold the cab while I was working it. I had strong fingers from working on the farm, so it didn't matter to me if I just gripped the cab in my fingers, though while polishing it was a bit difficult to hold onto. A few years later, I learned that I had better control and precision with a dopped cab.

After many years of wear and tear on my fingers and hands, both at work and with my hobby, I started to get more pain and stress in my fingers and wrists. I learned from my work environment that activities in my lapidary work were contributing to the pain and stress. If you are routinely firmly gripping small, slippery objects with the tips of your fingers, especially in cold water, you will soon incur stress injuries in the tendons of your lower wrists.

The main thing to do to reduce this stress is to make the object you are gripping larger and less slippery. As a result, I now use wood dop sticks, and I use as large a dowel as will still fit the cab I'm working on (up to ¾ inch). If the cab is small (¼ inch or so), I whittle the working end of a ⅝-inch dowel down to about the size of the cab and apply a small amount of dop wax to the end.

I use the green dop wax exclusively in my cabbing activities. A number of years ago, when superglue came on the market, I tried it on an opal. It was a disaster because, as I tried to remove the cab, the glue broke a divot out of the back and ruined it. This convinced me to make the green dop wax work all the time.

There are five reasons dop wax fails:

1. The dop wax sits on the bench in the dop pot, cooking away for many hours, and the volatiles that make the wax stick get boiled off. Adding new wax doesn't fix the bad wax; it just dilutes the mixture for a short while.

2. If you don't take extra time to make sure all the polish is washed off the dop stick and the wax before sticking it into the dop pot, the polish quickly contaminates the hot wax in the dop pot.

3. The stone's surface and the end of the wax on the dop stick haven't been cleaned enough before starting the dopping process.

**Using the alcohol lamp, I can get the stone, wax, and dopped stone much hotter than with the dop pot.**

4. Neither the stone, which is heated on the edge of the dop pot, nor the wax on the dop stick has been brought up to the ideal dopping temperature.

5. You have left the dopped stone in your cold workshop overnight or longer, and the low temperature has loosened the hold of the wax on the stone.

My solutions to the problems are:

1. I don't use a dop pot. Instead, I use an alcohol lamp to heat the stone and to heat the dop wax on the dop stick. This is the only time heat is added to the wax, the dop wax lasts many years. Because many of my cabs are large, they wouldn't fit on a dop pot anyway.

2. After I finish polishing, I scrub the polish off with a brush and soapy water, then dip the dopped stone in an ultrasonic cleaner, using detergent and water to remove all the remaining polish. The dopped stone then goes onto the freezer shelf in my small shop refrigerator. The cold will help the wax separate from the stone.

3. I wipe the surface of the stone and the surface of the wax on the dop stick with a cloth dipped in denatured alcohol. This cleans the stone and softens and cleans the dop wax prior to the heating process.

4. With the use of the alcohol lamp, I can get the stone, wax, and dopped stone much hotter than the dop pot is capable of doing.

5. Before I resume work on the dopped cab, especially if it has been left in a cold room overnight, I reheat it over the alcohol lamp to maintain the adhesive connection.

I have been using these methods for most of my lapidary career and I haven't had any situations in which the cab came off the dop stick during cabbing.

**For a small cab, I whittle down the working end of a ⅝-inch dowel.**


Bob Rush has worked in lapidary since 1958 and metal work and jewelry since 1972. He teaches at clubs and at Camp Paradise. Contact him at rocksbob@sbcglobal.net.

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# Tracking Utah's Dinosaurs


**The St. George Dinosaur Discovery Site at Johnson Farm is the biggest attraction in St. George and one of the world's most visited dinosaur track sites.**

## Footprints Are Preserved in St. George

Story and Photos by Steve Voynick

Dr. Sheldon Johnson, a retired optometrist in St. George, Utah, knows from firsthand experience that great discoveries are sometimes made when least expected. In February 2000, Johnson was leveling a low sandstone hill on his alfalfa farm on the south side of St. George. For more than a year, he had been moving sandstone with a track loader and hauling it away in a truck. Criss-crossed with cracks and joints, the reddish sandstone broke loose in large blocks, which Johnson sometimes sold for landscaping use.

**This exceptionally well preserved *Eubrontes* track cast show details of the dinosaur's toe pads.**

**A life-size recreation of *Dilophosaurus* in a walking posture is set in a 60-foot-long *Eubrontes* trackway consisting of 20 real, individual track molds.**

**This 12-inch-long, fossil specimen of *Semionotus*, an early Jurassic fish, shows fin patterns and bright, diamond-shaped ganoid scales; a reddish hematite concretion surrounds the fossil.**

One day, while he was loading the truck, a block fell to the ground and landed upside down. In the center of the block, Johnson noticed an odd, irregular feature: a three-dimensional cast of a three-toed foot that looked very similar to photographs that he had seen of dinosaur tracks. Curious, Johnson began turning over other sandstone blocks and found another track—and then another, and another.

Suspecting that the casts might be of scientific interest, Johnson and his wife, LaVerna, reported the find to area paleontologists, who immediately visited the farm and confirmed that they were part of a major dinosaur track site. After a preliminary assessment, the paleontologists, astounded by the number of well-preserved tracks, ranked the discovery as North America's top dinosaur-track site and one of the 10 best in the world.

When paleontologists from universities, museums, and the Utah Geological Survey began arriving in droves, Sheldon and LaVerna granted them full access to their property. It quickly became clear that the Johnsons' discovery was just the tip of the iceberg. Within weeks, many more tracks and several different track layers were discovered. The discovery was widely publicized, and more than 55,000 visitors flocked to the site over the next four months.

The red sandstone on the Johnson Farm is part of the Whitmore Point Member of the Moenave Formation and dates to the early Jurassic Period, about 200 million to 195 million years ago. At that time, dinosaurs had already existed for 30 million years and were just becoming established as Earth's dominant terrestrial vertebrates, a position they would hold for the next 135 million years.

The familiar and much larger dinosaurs of the Cretaceous Period, such as the carnivorous *Tyrannosaurus* and the herbivorous *Triceratops*, would not appear for another 100 million years. But because the early Jurassic dinosaurs that made the tracks at Johnson Farm had had received relatively little study, the new site had special paleontological significance.

On the Johnson Farm, paleontologists began mapping the maze of new, in situ dinosaur tracks as they discovered them, and documenting those that had already been excavated using tracings, measurements, photographs and casts. Along with the tracks, they found many sedimentary structures and evidence of invertebrate activity in the sandstone that provided clues about the early Jurassic environment that existed when the tracks were made.

From the beginning, both scientists and the citizens of St. George believed that the site, with its numerous, well-preserved tracks and easily accessed location, would make a superb educational resource and public attraction. And when the nonprofit organization DinosaurAh!Torium was founded in 2001 to secure government grants and private funding and oversee development of a dinosaur track museum, Sheldon and LaVerna took the first big step toward achieving this goal by generously donating the

**This rare manus or "hand" impression of a *Dilophosaurus*-type dinosaur is one of just six such impressions known in the world.**

**A *Eubrontes* track cast appears amid an intricate pattern of mud-crack casts.**

land on which the tracks were discovered to the city of St. George.

As scientists donated their time and knowledge, many St. George community members responded with contributions and volunteer help. Two local residents even purchased adjacent land where dinosaur tracks had also been discovered to protect it from future development. Formal recognition of the generosity and efforts of the Johnsons and the growing number of scientists, contributors and volunteers who supported the project was entered into the *Congressional Record* on Oct. 26, 2005.

In 2006, six years after the tracks were discovered, the St. George Dinosaur Discovery Site at Johnson Farm opened as an educational and interpretive site. The visitor center is a cavernous 16,000-square-foot structure that encloses a large area of sandstone bearing hundreds of in situ dinosaur tracks. The visitor center also houses numerous track blocks and track-related and fossil exhibits, along with a gift shop. Since it opened, Dinosaur Discovery Site has drawn 100,000 visitors annually, making it St. George's most popular attraction and one of the world's most visited dinosaur track sites.

Dinosaur ichnology—the study of dinosaur tracks—is a rapidly developing field of paleontology. The word "ichnology" is rooted in the Greek *ichnos*, meaning "footprint" or "track." When dinosaur tracks were first identified in the 1890s, they were considered little more than paleontological oddities. Even as recently as the 1960s, paleontologists interpreted dinosaur tracks only in terms of paleobiology, studying them to glean bits of information about taxonomic identification of the creatures that made them, type and speed of locomotion, and paleogeographic species range.

Today, however, dinosaur tracks are studied from a much broader perspective. Tracks, track sites, host sediments, and associated trace fossils are considered valuable sources of information about the behavioral patterns and physical habits of dinosaurs and other contemporary life forms, as well as the nature of the paleoenvironment in which they lived.

It is amazing that any dinosaur tracks survive at all, given the rather precise sequence of environmental and geological conditions required for their preservation. The process begins with proper sediment consistency, which is determined primarily by water content and the size of the sedimentary particles. The sediments or mud must be just moist enough retain initial track impressions. If the mud is too wet, the impressions will not be retained; if it is too dry, the impressions, if they exist at all, will be indistinct and barely noticeable.

Most preserved dinosaur tracks were originally made on shoreline mudflats where water levels repetitively rose and receded. After the tracks were made, warm, dry air was needed to "set", or harden, the mud sufficiently to retain the impressions that would subsequently be immersed in rising water. That water then had to deposit additional sediments of a slightly different composition within the impressions.

Next, the entire mudflat had to be buried deeply enough to generate sufficient heat and pressure to eventually lithify the unconsolidated sediments into solid sandstone. Finally, many millions of years later, erosion had to uncover the track strata in a manner that exposed, but did not destroy, the now-fossilized impressions.

Fossilized dinosaur tracks in sandstone are either molds or casts. Molds, or "positives", are the concave forms of the original track impressions. These positive impressions filled with secondary sediments that formed casts, or "negatives", that appear as inverted, convex replicas of the bottom of the dinosaurs' feet.

The unusually fine-grained sediments of the Moenave sandstone made possible the extraordinary degree of track preservation that often retains details of dinosaur feet, including pads, claws, and occasionally even skin patterns. Because the composition of mold and cast sediments are slightly different, sandstone

**A volunteer preparator at Dinosaur Discovery Site's Fossil Preparation Laboratory reliefs the fossilized skull of a phytosaur.**

**This 26-ton dinosaur-track block, the largest ever collected in the world, has 49 detailed *Grallator* track casts.**

**A Dinosaur Discovery Site docent shows visitors a sandstone block with a large *Eubrontes* track and mud cracks.**

strata can sometimes split at the boundary of the two types of sediments, leaving one surface with molds and the other with casts of the same tracks.

Dinosaur tracks are referred to by ichnotaxa names, or "track names", which must not be confused with the zoological, taxonomic names of the dinosaurs that actually made the tracks. Dinosaur track names are based on track characteristics, while zoological, taxonomic names are based on the measurements and characteristics of physical remains, usually fossilized bones and teeth. Track names are necessary because it is rarely possible to confirm that a member of a certain dinosaur genus made a specific set of tracks.

During the early Jurassic Period at what is now St. George, conditions for dinosaur track preservation were nearly ideal. The region then consisted of shoreline mudflats at the edge of a large, shallow, saline lake. This lake was rich in aquatic life, while the surrounding land hosted a thriving dinosaur population.

At Dinosaur Discovery Site, most of the thousands of tracks discovered to date were made by two types of bipedal, carnivorous dinosaurs (theropods) with the track names *Grallator* and *Eubrontes*. *Grallator* ("stilt-walker") tracks, which are the most common, were made by a dinosaur similar to *Megapnosaurus* ("big, dead lizard"). *Megapnosaurus* stood just 3 feet high at the hips, had a nose-to-tip of tail length of 8 feet, weighed about 50 pounds, and roamed in small herds.

The detailed *Eubrontes* ("true thunder") tracks are 13 to 18 inches long and are the footprints of a dinosaur that was very similar to the crested *Dilophosaurus* (double-crested lizard), the largest of the early Jurassic dinosaurs. An adult *Dilophosaurus* stood 6 feet high at the hips, was 20 feet long, and weighed about 1,000 pounds. It walked upright on powerful legs and used its much smaller forelimbs to grasp prey, mainly fish.

**The entranceway to the main exhibit area at Dinosaur Discovery Site leads through an expanse of in situ sandstone with hundreds of dinosaur tracks.**

Visitors to Dinosaur Discovery Site are greeted by a lifelike model of *Dilophosaurus* walking across an expanse of sandstone in a 60-foot-long *Eubrontes* trackway with 20 individual track impressions. These tracks appear in the in situ sandstone exactly where they were discovered; the museum structure was built over this in situ trackway to enclose and protect it.

An adjacent "split-layer" exhibit features a pair of 2-foot-thick, 6-foot-long sandstone blocks, each weighing several tons. These blocks were once a single, massive piece of sandstone that split evenly along the layer that separates the track molds from the casts. This split has exposed 67 small *Grallator* tracks and three large *Eubrontes* tracks. One block is displayed horizontally and shows convex track casts; the other block, displayed vertically, shows the perfectly matching concave track molds.

Another exhibit—the largest dinosaur-track block ever collected to date—displays a huge, vertically mounted sandstone block 8 feet tall, 14 feet long, 2 feet, and weighing 26.2 tons. On its smooth surface are 49 *Grallator* track casts made by several different individuals. This fossilized record of a straight-line, walking gait is helping paleontologists to extrapolate data about the bone structure, leg movements, and walking speed of the dinosaurs that made them. Because of this block's extraordinary size and weight, it was mounted in place before the museum was later built around it.

Alongside this massive track block is a lifelike recreation of *Megapnosaurus*, the type of dinosaur that made the *Grallator* tracks. Because no commercial replicas of early Jurassic dinosaurs were available, Dinosaur Discovery Site's *Megapnosaurus* and *Eubrontes* recreations were specially designed and constructed through a collaboration of local paleontologists and local artists.

Many of Dinosaur Discovery Site's track casts are on sandstone surfaces decorated with intricate networks of mud cracks. These crack patterns originated when submerged mudflats were exposed to air. The drying mud contracted to form deep cracks (molds) that were later filled in by other sediments to form casts. Many tracks are superposed on the mud cracks, indicating that the dinosaurs walked on surfaces of partially dried and already-cracked mud.

Because the tracks at Dinosaur Discovery Site were made by bipedal dinosaurs, almost all the molds and casts are of feet. However, one combined impression of feet, ankles, hips and "hands" was actually made by a *Dilophosaurus*-type creature that had squatted down. One of just six such impressions known in the world, this is the only one that shows clear manus (hand) impressions. The dinosaur had rested on its hind end with its "hands" down and claws curled inward, giving paleontologists clues into how dinosaurs moved and positioned their limbs. Paleontologi-

 from page 21

cal interpretations of this unusual track record describe a dinosaur that sat, scooted forward, then stood and walked away.

Another rare manus cast at Dinosaur Discovery Site has been assigned the track name *Anomoepus*. This track was probably made by *Scutellosaurus* ("little shielded lizard"), a small, 4-foot-long dinosaur that weighed just 20 pounds. With its back covered by tough, platelike scales, *Scutellosaurus* was one of the first armored dinosaurs. The track name *Anomoepus* means "unlike foot" and alludes to its five-toed hands versus three-toed feet. Although the *Anomoepus* track is only 4 inches long, it clearly shows four of the five hand toes.

Dinosaur Discovery Site also displays impressions of dinosaur "swim tracks" that were made by dinosaurs negotiating water deep enough to provide at least partial buoyancy. While propelling themselves by paddling their hind legs, they created repetitive scrapes in the lake-bottom sediments. Most swim tracks consist of three parallel grooves that were made by the dinosaurs' claws and toes.

"Tail drags" are another type of dinosaur impression. Tail-drag impressions are very uncommon because, contrary to early ideas about dinosaurs, they rarely, if ever, dragged their tails. According to current paleontological theory, dinosaurs actually held their long tails up and off the ground to counterbalance the weight of their large heads and heavy necks.

Sedimentary structures that appear on many track blocks also provide information about the early Jurassic paleoenvironment. Sedimentary structures are features in the sandstone that were created when wind, water, and various forms of plant and invertebrate life disturbed the original sediments.

"Rill marks" appear as miniature river channels that were scoured out of sediments by water flowing down sloping riverbanks or beach areas. Symmetrical and asymmetrical "ripple marks" result from water flowing repetitively back and forth, as in shoreline waves. "Tool marks" are scrape impressions made when water currents carried wood or other material over the sediments.

"Raindrop impressions" are records of large raindrops falling onto soft mudflats to form tiny, circular depressions. Another sedimentary structure consists of semicircular patterns, made when wind or water currents moved anchored plants in repetitive, back-and-forth motions.

Some dinosaur-track blocks also reveal "swim tracks", made in shallow water by swimming fish with undulating, back-and-forth tail movements, or by fish that dragged their pectoral or pelvic fins through the soft lake bottom sediments.

One such creature is represented in a complete fossil of *Semionotus* ("flag-back"), a fish with a prominent dorsal fin common found in lakes of the late Triassic and early Jurassic periods. This remarkably detailed, 12-inch-long fossil includes fin patterns and bright, diamond-shaped ganoid scales, the latter consisting of specialized bone material with a shiny, enamel-like outer layer. The fossil is surrounded by a concretionary mass of reddish hematite (iron oxide). When it has been fully studied, paleontologists expect to assign this fossil a new *Semionotus* species name.

**Paleontologists believe these inch-wide circular casts are traces of tadpole nests and may represent the earliest evidence of true frogs.**

Other track blocks contain mazes of fossilized, tunnel-like impressions that were made by wormlike invertebrates that burrowed through lake bottom and mudflat sediments in search of food. One block even has numerous, 1-inch-wide, circular depressions that may be tadpole nests, similar to those of modern tadpoles. Paleontologists suggest that these traces may represent the oldest known fossil evidence of true frogs.

Fossilized stromatolites also occur in the local Moenave sandstone. These mounded sedimentary masses originally consisted of alternating layers of calcium carbonate, sediments and cyanobacteria; the last is a group of primitive, photosynthetic bacteria that were among the first forms of life to evolve 3.5 billion years ago. Because they produced molecular oxygen through photosynthesis, cyanobacteria were vital in creating an oxygen-rich atmosphere that would become capable of supporting increasingly advanced forms of life. Dinosaur Discovery Site displays a 3-foot-long, silicified, pale-green stromatolite specimen with a distinctly botryoidal surface texture.

Also among the exhibits is a 1-foot-long tufa concretion that formed when calcium carbonate precipitated around an organic nucleus, probably a branch or twig. Over time, both the wood and the calcium carbonate were replaced by silica colored red by hematite. This well-silicified specimen has been cut and polished to show off and intensify its rich, reddish color.

The sandstone track blocks at Dinosaur Discovery Site, with their combinations of dinosaur tracks, sedimentary structures, and invertebrate traces, represent a fascinating picture of the teeming life that thrived on an early Jurassic lakeshore environment nearly 200 million years ago. The site's many displays are accompanied by excellent interpretive signs. And a staff of knowledgeable docents, some of whom have been associated with this site since the tracks were discovered, is always on hand to answer visitors' questions.

Dinosaur Discovery Site also has a fossil preparation laboratory where trained volunteers clean and relief fossils from this site and others throughout southern Utah. Visitors can observe preparators at work through a special viewing window.

Dinosaur Discovery Site continues to grow in scientific importance and is already the subject of dozens of technical articles in paleontological journals. Some 4,000 tracks have now been discovered over a 10-acre area in more than two dozen stratigraphic track levels. Dinosaur Discovery Site is a fine example of what can happen when science, government, and a community join together to achieve a common goal.

St. George is in southwest Utah on Interstate 15 about 120 miles north of Las Vegas, Nevada. The St. George Dinosaur Discovery Site at Johnson Farm is located at 2180 East Riverside Drive in St. George. Admission is $6 for adults and $4 for children ages 4-11; children under 4 are admitted free. For additional information and hours of operation, call (435) 574-3466 or visit www.dinosite.org.

## Show Dates *from page 10*

at (415) 383-7837. ; contact Jerry Tomlinson, PO Box 1371, Sausalito, CA 94966, (415) 383-7837; e-mail: jerry@crystalfair.com; Web site: www.crystalfair.com

**14-15—TAHLEQUAH, OKLAHOMA:** Annual show; Tahlequah Rock & Mineral Society, Tahlequah, OK; 300 W. First St; Fri. 9;00 am-6:00 pm, Sat. 9:00 am-5:00 pm; Adults $3.00 18 and over; Fluorescence and other Educational displays, Silent auction, Demonstrations, Children's Games, Door Prizes and Snack Bar.; contact Sara Brasel, 14236 Cross Timbers Rd, Tahlequah, OK 74464, (918) 284-5770; e-mail: rockhoundsally@aol.com; Web site: tramsok.webs.com

**14-16—SACRAMENTO, CALIFORNIA:** Wholesale and retail show; Gem Faire Inc, Scottish Rite Center; 6151 H St; Fri. Noon-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Students, Adults + Seniors $7, Children ages 0-11 are free!; Fine jewelry, precious & semi-precious gemstones, millions of beads, crystals, gold & silver, minerals & much more at manufacturer's prices. Exhibitors from around the world. Jewelry repair & cleaning while you shop. Free hourly door prizes. ; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: http://www.gemfaire.com

**14-16—PORT TOWNSEND, WASHINGTON:** Annual Rock and Gem Show in conjunction with the Jefferson County Fair; Port Townsend Rock Club, Jefferson County Fairgrounds; 4907 Landers Street; Fri. 10 am-9 pm, Sat. 10 am-9 pm, Sun. 10 am-6 pm; Admission is Free for show, -- fair has gate fees; Fair admission gate prices Adults - $6 Seniors (65+) - $5 Students (13 – 17) - $5 Children (6 – 12) - $2 Age 5 and under – free Three-day Season Tickets include Sunday's Beef BBQ in Advance $13 at gate $15 ; contact Garnett Brooks, (360) 379-5531; e-mail: garnett@email.com

**14-16—GRAND RAPIDS, MICHIGAN:** Faceting Seminar; Midwest Faceters Guild, Tallmadge Township Hall ; O-1451 Leonard NW; Fri. 4:30 pm-8:00 pm, Sat. 8:30 am-5:00 pm, Sun. 8:30 am-5:00 pm; Admission = see information; Learn to Facet - classes in beginners - all equipment furnished - Advanced - bring your machine and rough and we will assist you with new techniques and designs - GemCad - a computer aided software for gemstone designs. - Need to bring a laptop. Price for beginners class and Gem-Cad is $95.00 - Advanced classes are $50.00 - Information packets will be mailed upon request.; contact Barb Yost, (616) 254-9777; e-mail: barbandben@gmail.com

**14-16—SEASIDE, OREGON:** Annual show; Jean Miller, Seaside Convention Center; 415 1st Ave.; Daily 10 am-6 pm; Admission is free; Beads, Fossils, Gems, Minerals, Crystals, Petrified Wood, Sunstones, Turquoise, Jewelry, Opal, Native American Jewelry, Rough and Polished Rock Free Admission Free Pearls to the first 75 women through the door daily For more info call Jean Miller 971-219-0323 or e-mail karmicbeadsandgems@yahoo.com; contact Jean Miller, (971) 219-0323; e-mail: karmicbeadsandgems@yahoo.com

**14-16—PARRSBORO, NOVA SCOTIA, CANADA:** 50th Annual - Nova Scotia Gem and Mineral Show; Fundy Geological Museum, Lion's Arena; 2163 Western Avenue, Canada; Fri. 10 am-7 pm, Sat. 10 am-5 pm; Adults $5.00; Celebrating the 50th Anniversary this year, there will be a special gold theme and events throughout the weekend. Over thirty vendors from the region and across Canada. Workshops and demonstrations, field trips and presentations occur throughout the weekend. Originally the Parrsboro Rockhound Roundup founded in 1966 by Eldon George and others from Parrsboro, the Gem Show is the largest show in the Maritime Provinces. The Fundy Geological Museum will also be hosting a Gold exhibit and providing gold activities in a Prospectors Camp throughout the summer. This is the year to visit Nova Scotia! ; contact Sandra Tanner, (866) 856-3466; e-mail: sandra.tanner@novascotia.ca; Web site: http://fundygeological.novascotia.ca/gemshow

**14-16—LEBANON, PENNSYLVANIA:** Wholesale and retail show; Mid-Atlantic Gem and Mineral Association, Lebanon PA County Fairgrounds and Expo; 80 Rocherty Road; Fri. 10:00 am-6:00 pm, Sat. 10:00 am-6:00 pm, Sun. 10:00 am-4:00 pm; Adults $6.00, Children are Free!; The Gem Miner's Jubilee is an annual gathering of the finest vendors of gems, minerals, fossils, beads and Jewelry. There are classes and ongoing demonstrations daily. Outdoor tailgate section featuring fine minerals. Free and handicapped parking; air-conditioned halls.; contact Teresa Schwab, PO Box 15513, Chevy Chase, MD 20825, (301) 807-9745; e-mail: beadware@rcn.com; Web site: www.gem-show.com

**15-15—SHELTON, WASHINGTON:** Annual show; Shelton Rock and Mineral Society, Shelton Soccer Park; 2102 Johns Prairie Rd; Sat. 9 am-5 pm; Admission is Free; 6th Annual Tailgate Rock Sale and Swap. All rockhounds are invited to bring their rocks, minerals, fossils, and rock crafts to sell or trade. Tailgate space $15 Raffle, door prizes, rock display. Shoppers and browsers free admission and free parking. Visit our club on Facebook; contact Susan Perrault, Shelton, WA 98584, (360) 275-9432; e-mail: srms242@yahoo.com; Web site: www.sheltonrockclub.weebly.com

**15-16—BOSSIER CITY, LOUISIANA:** Annual show; Arklatex G&M Society, Bossier City Civic Center; 620 Benton Rd; Sat. 10:00 am-5:00 pm, Sun. 10:00 am-5:00 pm; Adults $4.00, Students $1.00, Children under 12, and scouts in uniform are Free!; "Earth Treasures of Louisiana", Custom and Unique Jewelry,

Gems, Minerals, Fossils, Educational Exhibits and Kids Games.; contact Del Glasner, P.O. Box 6633, Bossier City, LA 71171-6633, (318) 517-7372; e-mail: larockclub@gmail.com; Web site: larockclub.com

**20-23—WOODLAND PARK, COLORADO:** Annual show; Rock Gypsies, Woodland Park Saddle Club grounds; 19570 E HWY 24; Thu. 9:00 am-5:00 pm, Fri. 9:00 am-5:00 pm, Sat. 9:00 am-5:00 pm, Sun. 9:00 am-5:00 pm; Admission if Free!; The Woodland Park Rock, Gem and Jewelry show is located in the beautiful Rocky Mountains. We have over 40 dealers with Gems and Minerals from all over the world, including Colorado Minerals. You will meet custom jewelers who can sell you beautiful one of a kind jewelry. Kids will have a ball in the kids digging area. Food and fun for everyone and it's all free!! If you can't get enough, The Lake George Rock and Gem cub is also having a show 20 minutes up the road. See 2 shows in one weekend!; contact Kim Packham, (719) 360-9665; e-mail: runninboar@hotmail.com; Web site: woodlandparkrockandgemshow.com

**21-23—SAN DIEGO, CALIFORNIA:** Wholesale and retail show; Gem Faire Inc, Scottish Rite Center; 1895 Camino del Rio S; Fri. Noon-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Students, Adults + Seniors $7, Children ages 0-11 are free!; Fine jewelry, precious & semi-precious gemstones, millions of beads, crystals, gold & silver, minerals & much more at manufacturer's prices. Exhibitors from around the world. Jewelry repair & cleaning while you shop. Free hourly door prizes. ; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: http://www.gemfaire.com

**21-23—SOUTH BEND, INDIANA:** Show and sale; Michiana Gem & Mineral Society, St. Joseph County 4-H Fairgrounds; Ester Singer Building, 5117 South Ironwood Road; Fri. Noon-7 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Adults $3.00, Students 6-12: $1.00, Children under 6 free; Michiana Gem & Mineral Society's 52nd Annual Jewelry, Gem, & Mineral Show and Sale; contact John Davis, South Bend, IN, (574) 232-8823; e-mail: sumu95@hotmail.com; Web site: www.michianagms.org

**21-23—LAKE GEORGE, COLORADO:** Annual show; Lake George Gem & Mineral Club, Lot next to Lake George Post Office; 38200 US Hwy 24; Fri. 9 am-5 pm, Sat. 9 am-5 pm, Sun. 9 am-5 pm; Admission is Free; Free parking; good selection local mineral specimens, meet local miners.; contact Rebecca Blair, P.O. Box 171, Lake George, CO 80827, (719) 330-8123 ; e-mail: blairra@hotmail.com; Web site: LGGMClub.org

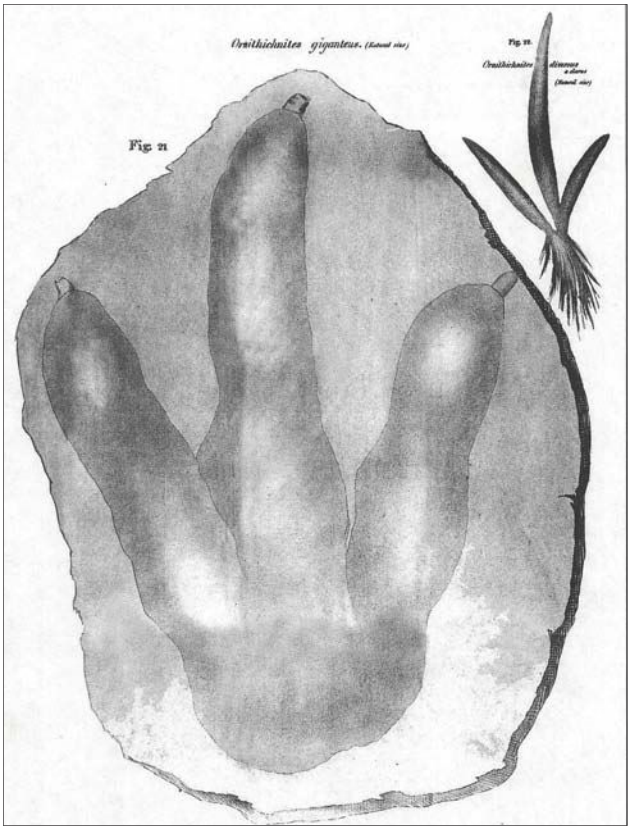
**22-23—PEORIA, ILLINOIS:** Annual show; Geology Section of the Peoria Academy of Science, The Grand Hotel; 4400

*continued on page 33*

# DINOSAURS of MASSACHUSETTS

COURTESY MEAD ART MUSEUM, AMHERST COLLEGE

**Massachusetts geologist Edward Hitchcock was the first to scientifically describe the Connecticut Valley fossilized trackways.**




**This 1836 drawing of a *Eubrontes giganteus* fossil footprint was likely made by Edward's wife, Orra White Hitchcock.**

## Tracks and Fossils Crisscross the State

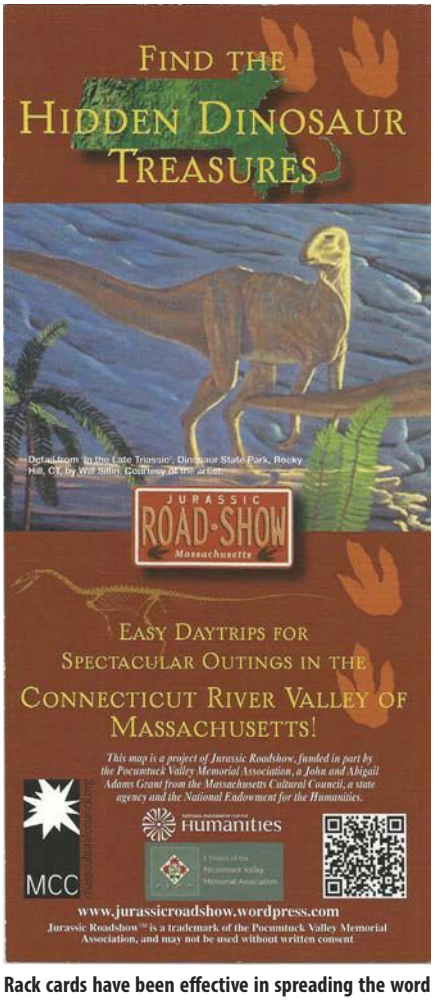
Story by Jordan D. Marché II

If the average person is asked where dinosaur tracks and fossils can be found across the United States, the Connecticut River Valley of Massachusetts may not immediately spring to their mind. More likely, they'll think of the American West, where the famous "bone wars" of rival paleontologists Edward D. Cope (1840–97) and Othniel C. Marsh (1831–99) were waged in the late 19th century, amid the rugged landscapes of Colorado and Wyoming.

Yet, *decades* before those struggles were played out, the Mesozoic rocks of Massachusetts and Connecticut—now recognized to be of Lower Jurassic age—revealed an extraordinary concentration of fossilized footprints (and occasional bones) attributed to animals that are now regarded as dinosaurs.

COURTESY SARAH DOYLE

**Jurassic Roadshow co-founder Sarah Doyle (right) talks with young visitors at the 2010 Cambridge Science Festival.**




**Rack cards have been effective in spreading the word about the Jurassic Roadshow.**

These fossilized trackways were first scientifically described in 1836 by Massachusetts geologist Edward Hitchcock (1793–1864) and predated by six years the naming of the *Dinosauria* by British paleontologist Richard Owen (1804–92).

Because the majority of trackways were made by bipedal (two-legged) animals, with each foot displaying three prominent, diverging toes, Hitchcock interpreted them as having been made by large birds. Some of these tracks were of extraordinary size; the three-toed footprints he called *Eubrontes giganteus* were sometimes over 15 inches long; the genus of the dinosaur that made them is as yet unidentiefied. The collection and study of these fossil footprints—a specialty dubbed "ichnology" by Hitchcock—became a hallmark of his later scientific career.

Despite the continuing attention given by scientists to Hitchcock's fossil footprints and other dinosaurian fossils found within the Connecticut Valley, these important collections were not widely known among the general public through the late 20th century. But from a combination of factors, this region's extraordinary fossil resources are now linked through a grant-supported network of institutional and outreach activities. Jurassic Roadshow™ offers families the opportunity to explore firsthand leading dinosaur-themed attractions and travel destinations in a series of self-guided day trips throughout western Massachusetts.

Since 2010, Jurassic Roadshow has taken its educational ventures to another level by staging traveling exhibits at regional public fairs and at gem, mineral and fossil shows throughout the state. The Roadshow also hosts professional geologists or paleontologists who can answer visitors' questions and identify rock, mineral and fossil samples brought in for examination.

Through regional partnerships, Jurassic Roadshow has fostered collaborations among institutions, which have brought together scientists, educators, historians, and even artists to further the knowledge of this area's rich cultural past for visitors and residents alike. But this transformation didn't happen overnight. And it likely wouldn't have happened at all without the curiosity, enthusiasm and determination of its founder and project coordinator, Sarah Doyle.

Sarah, a graduate of Wellesley College, had not always been interested in fossils, nor was she initially aware of the Connecticut Valley's importance to dinosaurian paleontology. While taking a history of science course at the Harvard Extension, she came across the name of Edward Hitchcock and visited Amherst, Massachusetts, to conduct research on him. It was there that she began to learn about his dinosaur footprint discoveries and a later controversy he engaged in with Greenfield, Massachusetts, physician James Deane over who should get top billing for their discovery. But the lack of general information available about Hitchcock and the trackways surprised her and laid the groundwork for the conception of Jurassic Roadshow.


SPRINGFIELD SCIENCE MUSEUM

**Exhibits at the Springfield Science Museum, a Jurassic Roadshow founding partner, feature genuine dinosaur tracks and fossils.**

"I continued research on my own for a couple of years and started to look for a way to get the story to a wider public," Sarah says. She decided that some form of grant funding was needed, but "in order to get grant money, it would have to come [through] an institution." Sarah was urged to contact the Pocumtuck Valley Memorial Association (PVMA) in nearby Deerfield, Massachusetts, which proved fortuitous.

The PVMA had been founded in 1870, chiefly as a museum and library to preserve the artifacts and records of Deerfield's history stretching back to colonial times. But the building in which the PVMA is located had housed the original Deerfield Academy (founded 1798), in which Hitchcock had not only attended classes as a youth, but later taught and served as preceptor (i.e., principal). Furthermore, PVMA director Timothy Neumann proved open to collaborations, realizing that Sarah's project could potentially benefit his own institution's educational outreach.

As Sarah tells it, "Tim and I came up with the idea [for Jurassic Roadshow] together and wrote a grant application to the Massachusetts Cultural Council to get [it] started." Their proposal was funded by a John and Abigail Adams Grant from the MCC, starting in 2007. The name Jurassic Roadshow is derived from the popular (and traveling) television show "Antiques Roadshow". "As soon as we had it, we knew it was a good name," she recalls.

Next, a recognizable logo for the collaborative venture was needed, which was ably supplied by local artist John Kanzler, who produces illustrations for children's books. It features an iconic Massachusetts license plate with the Jurassic Roadshow emblem and dinosaur tracks. Sarah adds, "I think it's clever, very eye-catching, and it conveys the ideas of dinosaurs, travel and exhibits."

One of the successful ways of spreading word about Jurassic Roadshow has been the distribution of rack cards. A two-sided "brochure" was developed that urged tourists and residents to "Find the Hidden Dinosaur Treasures". Nine localities—ranging from Barton Cove, in Gill (site of a former dinosaur footprint quarry), to the Springfield Science Museum—are briefly described, their locations are pinpointed on a regional map, and associated Web sites are provided. Collectively, these interpretive centers offer "easy daytrips for spectacular outings in the Connecticut River Valley of Massachusetts".

The two basic components behind the Roadshow idea were implemented almost simultaneously. As Sarah explained, "Tim and I knew that there were other organizations around here that had an interest in the tracks, but no one had ever strung them together." One of their first accomplishments was to arrange a meeting of the area's leading interpretive centers. The goal was "to talk about ways to create tourism on this theme. It just required connecting everyone," Sarah noted. "Interestingly, people from these organizations had never met, even though they aren't far apart."

Those organizations soon became partners in the Jurassic Roadshow project. Among the foremost attractions is the new Beneski Museum of Natural History at Amherst College, which opened its doors to the public in 2006. This state-of-the-art museum is home to the world-class Hitchcock Ichnology Collection of dinosaur tracks and fossils, whose specimens number in the thousands. Its newer display techniques, including LED lighting and roll-out shelves, have made the track specimens far more accessible to visitors and easier for them to appreciate. The Beneski Museum has once again given the Hitchcock footprint collection the prominence that it rightly deserves.

Another significant resource is a grouping of dinosaur footprints, including large *Eubrontes* tracks, that is preserved in situ along state Route 5, between Holyoke and Northampton. This property, acquired by the state in 1935, is managed by The Trustees of Reservations (TTOR). In 1972, Yale University paleontologist John Ostrom had argued that the nearly parallel orientations of the Holyoke footprints suggested that the animals who made them were traveling in groups—a modern proposal of social behavior among the dinosaurs.

Yet, in 1836, Hitchcock had studied a group of four similarly-aligned trackways at the same site (then a working quarry) and reached the same conclusion, namely, that the "birds" who made them were perhaps "gregarious". An alternative argument was made that single animals might simply have been following the shoreline of an ancient lake, laying down their tracks independently over time. No one can say for sure which case it was.

In South Hadley, the Nash Dinosaur Track Site and Rock Shop contains a working quarry where tracks continue to be excavated, and are then sold to buyers from around the world. First opened in 1939 by entrepreneur Carlton Nash, the property is now managed by Carleton's son, Kornell Nash. It also features a museum in which a variety of dinosaur tracks and fossils are displayed. The Nash Track Site is located only about a mile away from where the very first dinosaur track, dubbed "Noah's Raven", was unearthed by a young farm boy named Pliny Moody in 1802. Moody's original footprint slab was later acquired by Hitchcock and is on display at the Beneski Museum.

Other founding partners that embraced the Roadshow collaboration include the Springfield Science Museum, whose exhibits feature genuine dinosaur tracks and fossils, a life-size *Tyrannosaurus rex* skeleton, and a surround-sound Jurassic Theater. Near the opposite (north) end of the valley is the Great Falls Discovery Center (GFDC), located at Turners Falls. This historic site showcases the natural, cultural and industrial history of the 410-mile-long Connecticut River watershed. The GFDC is housed within a cluster of old mill buildings; its Great Hall is

COURTESY SARAH DOYLE

**This *Dilophosaurus* sculpture, created by artist Jessica Denehy, of Patina Metal Designs, integrates the arts into the Roadshow.**


COURTESY SARAH DOYLE

JORDAN MARCHÉ II PHOTO

▲ **The Beneski Museum of Natural History houses the Hitchcock Ichnological Collection of dinosaur footprints.**

◀ **Families get a hands-on experience with fossils at the 2012 Jurassic Roadshow event on Amherst Common.**

a former machine shop. The Center is now operated by the U.S. Fish and Wildlife Service and the Massachusetts Department of Conservation and Recreation.

The GFDC coming on board proved to be something of a turning point in the development of the Roadshow's outreach activities. The Center had received a donation of dinosaur tracks from a local collector, Harry Sharbaugh, and considerable interest arose concerning those specimens. A GFDC board member, geologist Steve Winters, along with other local collectors, recommended putting together an exhibit about the tracks in August 2010. Paleontologist Patrick Getty, from the University of Connecticut, was invited to take part, and Nicholas McDonald, of Westminster School in Simsbury, Connecticut, who had helped to establish the Lower Jurassic age of the Connecticut Valley's Mesozoic strata, also agreed to help.

To raise the interest level, "we encouraged people coming to the exhibit to bring in their own fossils [for identification], as well, and talk to [experts] about what they had. It got a great response," Sarah recalled. In fact, "the event was such a success that we decided to truly take it on the road."

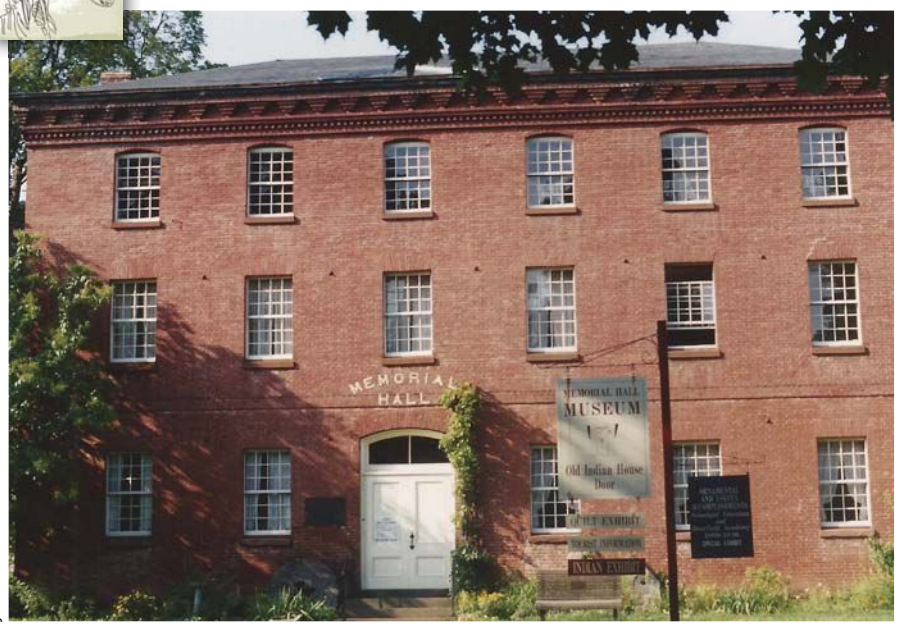
The town of Greenfield celebrated the bicentennial of the founding of Franklin County in 2011. In conjunction with this event, the PVMA and Jurassic Roadshow set up an exhibit that highlighted further aspects of the growing collaboration between the region's professional and amateur fossil enthusiasts. For example, paleontologist Dr. Mark McMenamin, of Mount Holyoke College, and his students participated in the 2011 Roadshow event. So did Dr. Paul Olsen of Columbia University, one of the leading researchers of the East Coast's Mesozoic geology and dinosaur footprints.

At a prior meeting, held at Smith College in Northampton, Olsen was consulting with the TTOR about their dinosaur footprint site. Sarah recalls, "he was very friendly and approachable, so I thought we could invite him up." He has since attended several Roadshow events, delivering a "terrific public talk" in 2011 and returning to Amherst in 2012. Dan Vellone, northeast regional state geologist for the U.S. Department of Agriculture's Natural Resources Conservation Service, has also been "enormously helpful to us," Sarah reports. Having such notable footprint researchers and other experts involved with the Roadshow was not only exciting, she said, but also "got people 'in the know' interested in what we were doing."

The scientific study of dinosaur footprints has long depended upon collaborations between amateur and professional collectors, something that was as true in Hitchcock's time as it is in the present. The names of many of the collectors who originally supplied footprints to Hitchcock had lapsed into obscurity, but are being revived thanks to interest generated by Jurassic Roadshow. They include the fossil-loving physician Deane; Dexter Marsh, of Greenfield, who assembled a track museum between 1846 and 1853; and Roswell Field of Gill, Massachusetts, who exchanged fossils with Sir William Jardine of Great Britain.

Sarah had also presented results from her research into the Hitchcock-Deane priority dispute at an earlier event, sponsored by the Greenfield Historical Society, where "someone in the audience turned out to be a collector of fossils and of Hitchcock's books". Other local collectors—too numerous to mention individually—have since become supporters of the Roadshow. These "Track Pack" members, as they call themselves, "are able to meet professional paleontologists and develop relationships with them," Sarah explained. "The professionals seem to truly enjoy this, too. It's a nice, relaxed way for them to have a good time and talk shop with some well-informed people who really want to learn." And the amateurs are more than willing to give back of their own time and knowledge.

Another obvious venue for spreading the word about Jurassic Roadshow is local and regional rock, mineral and fossil shows. The organizations and individuals responsible for hosting these shows have likewise become important advisors and partners in the Roadshow's continuing success. Richard Little, now professor emeritus of geology at Greenfield Community College and head of its Pioneer Valley Institute (PVI), has sponsored an annual show at his institution for nearly 20 years. An even larger annual show is the Western Massachusetts Mineral, Jewelry and Fossil Show, hosted by the Springfield-based Connecticut Valley Mineral Club. Their most recent (75th anniversary) show was held at Northampton in March 2015, where Jurassic Roadshow again set up its widely recognized tents, providing information and identifying dinosaur and other fossils for countless visitors.




JORDAN MARCHÉ II PHOTO

**Memorial Hall Museum is the home of the Pocumtuck Valley Memorial Association and the Jurassic Roadshow.**

Jurassic Roadshow has also participated in many non-geological public fairs that have drawn in wider audiences, attracting those involved with poetry, music, and the arts. It is impossible to list all these events, but a few highlights can be described. In 2012, for example, the PVMA and Jurassic Roadshow invited the Emily Dickinson Museum, the Eric Carle Museum of Picture Book Art, and the Jones Library (all located in Amherst) to prepare an exhibit for a street fair held on Amherst Common. Dickinson's family and the Hitchcocks were longtime friends, and Emily had learned some of her science through Edward Hitchcock's books. The connections between disciplines can be wide-ranging, indeed!

The Roadshow has likewise set up tents for Dinosaur Days, a part of the Old Deerfield Craft Fair hosted by PVMA, which offered a dinosaur craft contest, related children's dinosaur activities, and a Roadshow fossil display. Similar activities were presented at the Franklin County Fair (Greenfield), the Conway Festival of the Hills, and the Gill Crafts Fair, to name but a few. The Roadshow has played for the past five years at the Cambridge Science Festival—its most distant venue, to date—where it has been well received.

Another staunch advocate of the Roadshow connections among science, education, history, and the arts is embodied in the person of Dr. Robert "Bob" Herbert, professor emeritus of humanities at Mount Holyoke College and former professor of art history at Yale University. Herbert first became interested in the artwork produced by Hitchcock's wife, Orra White Hitchcock (1796–1863), who furnished the landscape sketches that were engraved as lithographic plates for Hitchcock's *Report on the Geology of Massachusetts* (1833 and later editions). Orra had been trained in both the fine arts and exact sciences, and taught those subjects at Deerfield Academy, where she first met Edward in 1814.

In 2011, Herbert co-curated an exhibit of Orra's artwork at the Mead Art Museum of Amherst College. He has devoted countless hours to transcribing and publishing Orra's travel diaries and Edward's 1850 diary of his travels in Europe. He has further researched the lives of footprint collectors Deane, Marsh and Field. Still more recently, Herbert has transcribed Hitchcock's voluminous correspondence with Yale University chemist and geologist Benjamin Silliman (1779–1864), founder of the scientific journal in which Edward's earliest papers on the geology of the Connecticut Valley, and his later researches on dinosaur footprints, were published.

Sarah regards Herbert's deep interest in the footprint story as "an incredible stroke of luck" for the Roadshow, and says that he has given the loose-knit group of local historians "a kind of center around which to coalesce".

I asked Sarah whether it had been difficult to acquire (and maintain) funding for Jurassic Roadshow over the years. She replied, "There was [a] huge enthusiasm right at the start [ca. 2007], but then the economic downturn hit everyone hard, and museums especially began to pull into themselves. Our collaboration wasn't old enough then to keep everyone active, but it was strong enough that at least people's interest remained, even if they couldn't commit funds. … The project survived on MCC grants for several years."

Since then, as the economy has improved, newer funding sources have been acquired. The National Endowment for the Humanities (NEH), the Institute for

COURTESY SARAH DOYLE

**Children make hand impressions in wet sand to simulate the creation of fossilized footprints.**

Museum and Library Services (IMLS), and most recently the National Park Service (NPS) have all provided financial support to the PVMA for outreach activities.

"It's a lot of work to write these [grants]," Sarah admits, "and then there are the interim and final reports, so we're kept on our toes." Over time, the number and nature of partnerships has also changed, as newer venues, audiences and ideas are continually explored.

Where does Jurassic Roadshow want to go from here? Funding from the IMLS and NEH has made it possible for the PVMA to plan, design and develop a new Web site about Edward and Orra Hitchcock that will be launched in 2016. This seems to be a natural progression, as a quantity of the Hitchcock family papers are maintained at the PVMA Library in Deerfield.

Hitchcock was a prolific scientist and author, and a very well known figure in antebellum American science. He had conducted the first complete state-sponsored geological survey (of Massachusetts), and in 1840 was elected first president of the Association of American Geologists, a group that rapidly expanded its membership and transformed itself into the present-day American Association for the Advancement of Science (AAAS). He likewise served as president of Amherst College (1845–54) and saved that institution from bankruptcy. Yet, outside the academic community, his name and accomplishments remain little known today—a situation that Jurassic Roadshow hopes to rectify!

A partnership with the National Park Service is also assured and will see greater development. Sarah says they are working "to enhance the casual educational use of their trails. We haven't settled yet on what technology we will use to do this. It's all changing so fast, it's a specialty just to keep up". One general goal is to have a "local/regional audience and a national audience, whom we have to reach in different ways." In order to include people who don't use social media, a host of options are being explored.

I asked Sarah whether any thought had been given to expanding Jurassic Roadshow into adjoining Connecticut, where equally exciting interpretive centers and museums, such as the extraordinary fossil footprints preserved at Dinosaur State Park in Rocky Hill and the famous Yale Peabody Museum of Natural History at New Haven. She replied in the affirmative, though she said the Roadshow has maintained its Massachusetts focus to date "partly because of PVMA's location, partly because there are so many collaborations here, and partly because we developed so much under MCC grants. … [N]ow that we have national funding from IMLS, we can cross the border," she noted hopefully.

Clearly, western Massachusetts's Connecticut River Valley boasts a variety of exciting institutions, organizations, interpretive centers, and museums that are closely related on the theme of dinosaur tracks and fossils.

For a complete list of the various destinations and upcoming events that are available for visitation and/or interaction, visit the Jurassic Roadshow Web site, http://jurassicroadshow.com. E-mail questions to JurassicRoadshow@gmail.com. Revised rack cards, printed with locations and maps of the sites (and more) described in this article, should appear in the near future. I hope that you will enjoy making your own personal discoveries of the remarkable geology and dinosaur paleontology of the Connecticut River Valley, in Massachusetts and beyond, with the help of Jurassic Roadshow.

# ROCK SCIENCE

by STEVE VOYNICK

## The Arsenic Twins

Red realgar and yellow-orange orpiment are widely collected for their bright and distinctive colors. Color aside, however, these two minerals could pass as mineral twins. Both are arsenic sulfides that crystallize in the monoclinic system, occur in the same mineralogical environments, and are nearly identical in the properties of hardness, specific gravity, and cleavage. Even their respective chemical formulas—$As_4S_4$ and $As_2S_3$—are similar.

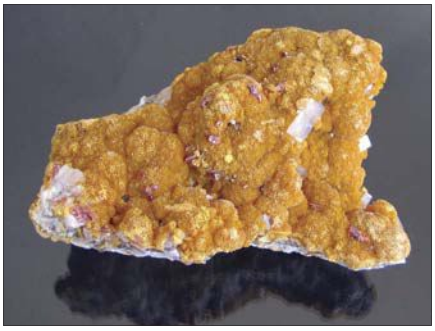
Both realgar and orpiment consist of roughly three-quarters arsenic. Arsenic's well-known toxicity is due to its chemical affinity for phosphorus, an element vital to all animal and plant cellular chemistry. Because arsenic readily substitutes for phosphorus in cellular compounds, even tiny amounts can disrupt normal cellular functions and metabolism.

Realgar has been used in Chinese medicine since around 1400 BC. The Chinese believed that ingesting realgar-based potions would prevent many diseases. Drinking rice wine mixed with finely powdered realgar was a tradition in ancient Chinese festivals. The remaining wine-realgar paste was used to decorate the foreheads and arms of children—a practice that survives today in some rural areas of China.

As pigments and medicinal compounds, realgar and orpiment were traded extensively throughout the Roman Empire. In Renaissance art, realgar was the primary pigment in orange-red paints. Unfortunately, the vivid, realgar-based paints in many celebrated works of art have faded to pale yellow-orange as the realgar altered into pararealgar.

Realgar and orpiment also served as the standard rat poison throughout Europe. By the mid-1700s, the two minerals were being prescribed to treat such diseases as syphilis—a use that continued until the early 20th century.

The atomic bonding in realgar is particularly interesting. If you've ever used straight mathematics to calculate the electrical balance of the realgar formula $As_4S_4$, you know it can't be done. The realgar molecule consists of four trivalent arsenic ions ($4As^{3+}$) and four divalent sulfur ions ($4S^{2+}$). The realgar cation $4As^{3+}$ would seem to have a +12 charge, rather than the +8 charge that would balance the -8 charge of the sulfur anion.



**The toxic element arsenic accounts for about three-quarters of the weight of both realgar and orpiment.**

But realgar's arsenic cation actually has an *effective* charge of +8, because three of its four arsenic ions are covalently bonded together in a chain. In this configuration, the two end ions of each arsenic chain retain a double charge, while the double-bonded center ion retains only a single charge. This gives the three bonded arsenic ions a collective +5 charge, while the single unbonded arsenic ion retains its normal +3 charge. This produces an effective +8 cationic charge and explains why realgar's formula is expressed as $As_4S_4$ rather than as AsS.

Interestingly, AsS is now the formula for pararealgar. Two other arsenic sulfides, like realgar, also have arsenic-arsenic bonds that belie the mathematical logic of their formulas: uzonite, $As_4S_5$; and alacránite, $As_8S_9$.

Realgar and orpiment occur in the same mineralogical environments and often in the same specimens. Whether arsenic and sulfur ions will form realgar or orpiment depends upon the temperature at the time of crystallization. Because realgar's arsenic-arsenic bonds are inherently weak and heat-liable, it crystallizes at lower temperatures than orpiment.

So realgar and orpiment represent much more than just bright colors. Don't forget about their fascinating histories and, in the case of realgar, that unusual bonding arrangement that must be understood to makes sense of its chemical formula.

Steve Voynick is a science writer, mineral collector, former hardrock miner, and the author of books like *Colorado Rockhounding* and *New Mexico Rockhounding.*

N. Brandywine Dr.; Sat. 9 am-5 pm, Sun. 10 am-5 pm; Admission is Free!; 52nd annual show; silent auctions; kids area; fluorescent display; panning flume; slabs; specimens; cabochons and faceted stones; jewelry; contact Jim Travis, (309) 645-3609; e-mail: boatnik@aol; Web site: http://pasgeology.com

**22-23—PEORIA, ILLINOIS:** Annual show; Geology Section of the Peoria Academy of Science, The Grand Hotel; 4400 N. Brandywine Dr.; Sat. 9 am-5 pm, Sun. 10 am-5 pm; Admission is Free!; 52nd Annual Show. There will be exhibits of fossils, geodes, specimens of all kinds, cabochons and faceted stones, jewelry, flint knapping and an outstanding fluorescent display. Activities include silent auctions, a kids area with games and prizes, a panning flume, door prizes and much more. Admission and parking are free.; contact Jim Travis, (309) 645-3609; e-mail: boatnik@aol.com

**22-23—SAN FRANCISCO, CALIFORNIA:** Annual show; San Francisco Gem & Mineral Society, SF County Fair Building; 9th Avenue & Lincoln Way; Sat. 10:00 am-6:00 pm, Sun. 10:00 am-5:00 pm; Adults $10, Seniors $8, Students $8, Children under 12 with adult free ; Dealers, displays, demonstrations, kids' activities, mineral and gem identification, silent and live auctions!; contact Ellen Nott; e-mail: ellen_nott@yahoo.com

**22-23—MOUNTAIN HOME, ARKANSAS:** Annual show; Ozark Earth Science Gem, Mineral, & Fossil Club, Baxter County Fairgrounds, (Educational Bldg.); 1507 Fairgrounds Drive; Sat. 9 am-6 pm, Sun. 9 am-4 pm; Adults $2., Seniors $2., Children under 12 FREE; Ozark Earth Science Gem, Mineral, & Fossil Club is sponsoring it's annual show this year at our NEW LOCATION at the Baxter County Fairgrounds located at 1507 Fairgrounds Drive, Mountain Home, AR. Admission is $2, active military with ID, Scouts in uniform, & Children under 12 yrs. FREE! Gems, Minerals, Fossils, unique crafts, jewelry, games, hourly door prizes, grand prize drawing, displays, AR. State Geologist for mineral/fossil information, DVD educational programs. Concession on location. Contact Sharon Waddell, 6463 US Hwy. 63, West Plains, MO. 65775, 417-274-8712 or Ernie Confer 870-425-1311: Website: www.ozarkearthscience.org/news.htm; contact Ernie Confer, AR, (870) 425-1311; Web site: www.ozarkearthscience.org/news.htm

**28-30—COSTA MESA, CALIFORNIA:** Wholesale and retail show; Gem Faire Inc, OC Fair & Event Center; 88 Fair Dr; Fri. Noon-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Students, Adults + Seniors $7, Children ages 0 - 11 Free!; Fine jewelry, precious & semi-precious gemstones, millions of beads, crystals, gold & silver, minerals & much more at manufacturer's prices. Exhibitors from around the world. Jewelry repair & cleaning while you shop. Free hourly door prizes. ; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: http://www.gemfaire.com

**29-30—FREEPORT, NEW YORK:** Retail show; Freeport Recreation Center, Freeport Recreation Center; 130 East Merrick Road; Sat. 10 am-5 pm, Sun. 10 am-5 pm; Students, Adults, & Seniors $5.50, Children 12 and under Free!; The show features dealers selling minerals, gems, jewelry, fossils, and beads. Goldsmith and silversmith. Find meteorites from other worlds, and prehistoric fossils from our own. Why pay shopping mall prices when you can get gems and minerals from around the world, and hand crafted gold and silver jewelry directly from the artist. Admission $5.50, -- With This Ad $5. Children 12 and under FREE with Adult. Every dollar of the admission fees helps support Freeport Recreation Center programs for children and seniors.; contact Ralph Gose, PO box 1418, Melville, NY 11747, (631) 271-8411; e-mail: ralph_gose@kaleidoscopegemshows.com; Web site: www.kaleidoscopegemshows.com

**29-30—ASHLAND, OREGON:** Annual show; Scott's Rocks, United Methodist Church, Wesley Hall; 175 North Main Street; Sat. 10:00 am-5:00 pm, Sun. 12:00 am-5:00 pm; Adults $2.00; Crystals, minerals, gemstone beads, hand crafted gemstone jewelry, fossils, precious opals. Free admission for children under 12. Silent auction. Free rock for each child. Free fossil leaf field trip on Monday, Aug. 31st. ; contact Scott Blair, (541) 621-2558; e-mail: scottsrocks@scottsrocks.com; Web site: scottsrocks.com

**29-30—CONCORD, CALIFORNIA:** Show and sale; Contra Costa Mineral & Gem Society, Centre Concord; 5298 Clayton Rd., near Ygnacio Valley Rd; Daily 10 am-5 pm; Adults $6.00, Children are Free!; Adults $6, children (under 16) free; 25 Dealers: gems, jewelry, fossils, minerals, crystals, jade, meteorites & Tekties, fluorescent rocks, lapidary tools & equipment, findings, books; 20 Demonstrations: cabbing, beading, wire-wrapping, faceting, stone setting, stone carving, gold panning, and more; 48 Exhibits and Educational Displays; Activities for all ages: youth and Scout activities, free rock and gem identification, silent auction, fluorescent display room, hourly door prizes, raffle. (Please Note: The August show date is a one-time change. In 2016 the Concord Gem Show will return on the first weekend in November); contact Harry Nichandros, CA, (925) 289-0454; e-mail: show-r@ccmgs.org; Web site: http://ccmgs.org

## September 2015

**4-7—RALEIGH, NORTH CAROLINA:** Retail show; Treasures of the Earth, Inc., NC State Fairgrounds; 1025 Blue Ridge Blvd; Fri. 12 noon-6 pm, Sat. 10 am-5 pm, Sun. 10 am-5 pm, Mon. 10 am-4 pm; Adults $5.00, Military Free with ID, Children16 and under Free; Vendors from across the US bring their merchandise to you. You will find • 14K and sterling silver, classic, estate, fashion and handmade jewelry • Loose stones, beads and findings, pearls • Mineral specimens, crystals, lapidary supplies • Books, carvings and gift items ; contact Jane Westbrook, PO Box 59, Gloucester Point, VT 23062, (804) 285-4281; e-mail: jane@treasuresoftheearth.com; Web site: www.treasuresoftheearth.com

**5-7—CANBY, OREGON:** Annual show; Jean Miller, Clackamas County Fairgrounds; 694 N.E. 4th Ave., (off Hwy. 99E); Daily 10 am-6 pm; Admission if free; Beads, Gems, Minerals, Crystals, Jewelry, Fossils, Silver, Turquoise, Opal, Sunstone, Petrified Wood, Thunder Eggs, Grab Bags, Rough and Polished Rock and much, much more! Fun for the whole family. Free pearls to the first 75 women through the gate daily For more info contact Jean Miller 971-219-0323 or e-mail karmicbeadsandgems@yahoo.com; contact Jean Miller, (971) 219-0323; e-mail: karmicbeadsandgems@yahoo.com

**11-13—GREENFIELD, INDIANA:** Annual show; 500 Earth Sciences Club, Hancock County 4-H Fairgrounds; 620 N. Apple Street; Fri. 10:00 am-7:00 pm, Sat. 9:00 am-7:00 pm, Sun. 10:00 am-4:00 pm; Admission is Free!; Dealers and Swappers in Fossils, Minerals, Gems and Jewelry and Lapidary Equipment Plus Silent Auctions, Door Prizes and much more. Kids Activities, Demonstrations, Educational Displays and Programs for All.; contact Cheryl Hamilton, 3507 Luewan Dr., Indianapolis, IN 46235, (317) 897-6639; e-mail: clhamilton1951@gmail.com

**11-13—RENO, NEVADA:** Wholesale and retail show; Gem Faire Inc, Reno Sparks Livestock Events Center; 1350 N Wells Ave; Fri. Noon-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Students, Adults + Seniors $7, Children ages 0 - 11 Free!; Fine jewelry, precious & semi-precious gemstones, millions of beads, crystals, gold & silver, minerals & much more at manufacturer's prices. Exhibitors from around the world. Jewelry repair & cleaning while you shop. Free hourly door prizes. ; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: http://www.gemfaire.com

**11-13—ORLANDO, FLORIDA:** Annual show; Central Florida Mineral and Gem Society, FL National Guard Armory; 2809 Fern Creek Ave.; Fri. 1 pm-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Adults $5, Students $2; Annual Fall gem, mineral, and bead show will be at the Florida National Guard Armory, 2809 South Fern Creek Ave. Orlando, Fl 32806. Show will be on Friday September 11, 1pm to 6pm, Saturday September 12, 10am to 6pm, and Sunday September 13, 10am to 5pm. Go to www.cfmgs.org for $1 off coupon. There will be demonstrations, 30 minute auctions, kids table, sluice mining for gems, and hourly door

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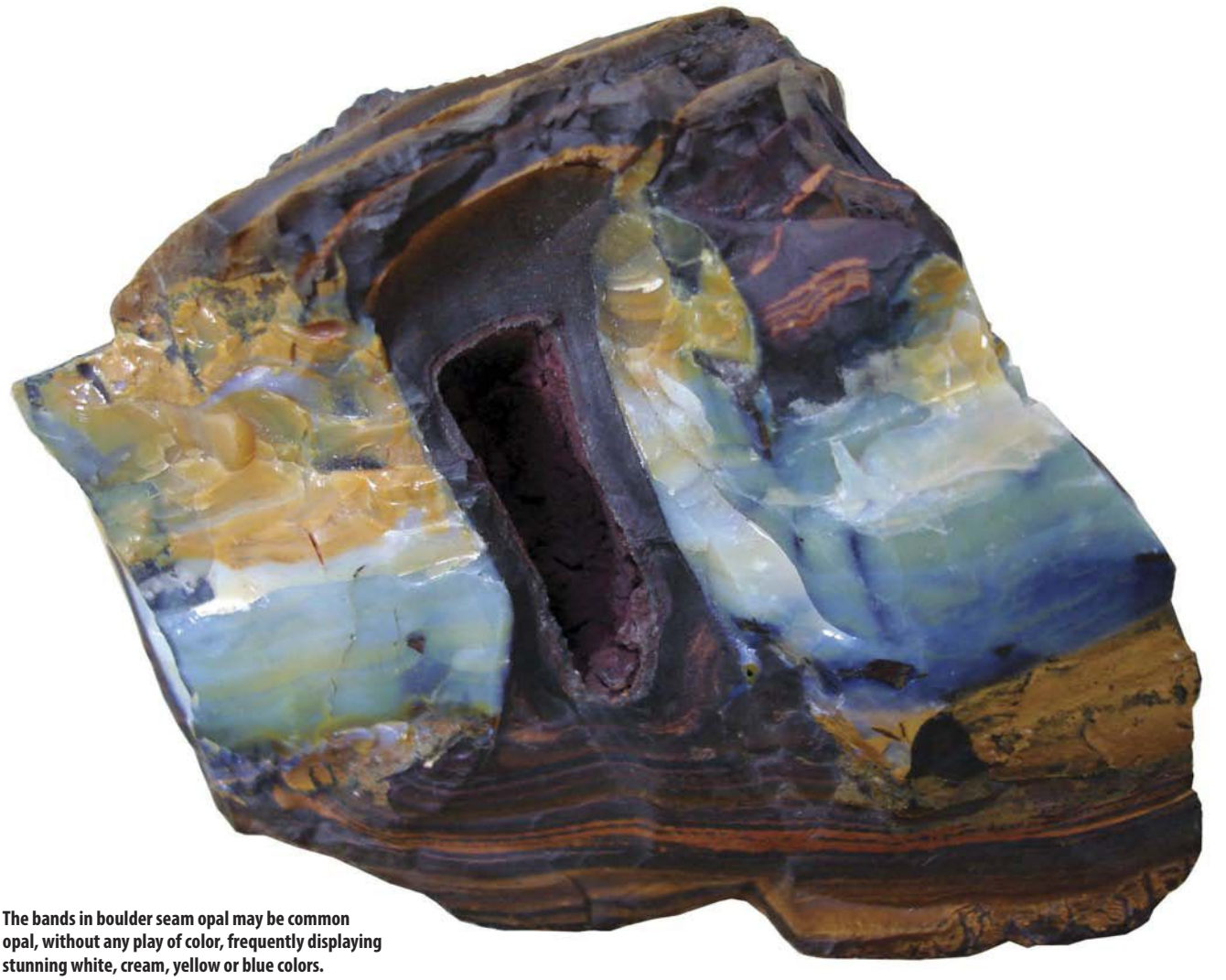
# BOULDER & MATRIX OPAL



HELEN SERRAS-HERMAN PHOTO

**The bands in boulder seam opal may be common opal, without any play of color, frequently displaying stunning white, cream, yellow or blue colors.**

## Fiery Veins Stand Out in Host Rock

Story by Helen Serras-Herman

Most of us are familiar with opal, the beautiful gem that displays an array of spectral colors. Opal, whether black or white, is commonly found in the field without being attached to any other materials, with the minimal exception of some sandstone. But there are times when opal forms in seams within the host rock (the matrix), creating what is known as boulder opal. The host, or parent rock is usually ironstone, mudstone or sandstone, but it may also be rhyolite, basalt or quartzite (*Opal Identification and Value*, by Paul Downing, Majestic Press Inc., 2003).

HELEN SERRAS-HERMAN PHOTO

**Yowah nuts are customarily cracked open in the field to see what's inside: opal worth thousands of dollars or worthless vugs.**

HELEN SERRAS-HERMAN PHOTO

**Huge pieces of opal conglomerate have come out of Yowah and Koroit, like this one that Peter MacKenzie is holding.**

HELEN SERRAS-HERMAN PHOTO

**This wonderful "chocolate opal" parcel has brightly-colored, fine opal veins in what the opal miners call the "biscuit band", a softer matrix.**

According to the authors of the latest opal grading and classification system from Opal Horizon Limited, presented at the 2011 GIA Symposium in Carlsbad, all opals fall into three types:

Type 1 includes solid opal-black and solid opal-light;

Type 2 is boulder opal (opal on host rock); and

Type 3 is matrix opal (opal in host rock).

This classification, with the addition of the term "natural" in the type of opal (i.e., Natural Type 1) is almost identical to the Australian gem industry standard, endorsed by the Gemmological Association of Australia and the Opal Association of Australia (www.opal.asn.au), as well as by Paul Downing, one of the experts in the field of opal.

The opal bands may be of precious opal, which displays the phenomenon of play of color, often showing spectacular flashes of red, blue and green. The bands may also be common opal, often referred to as potch. This is opal without any play of color, but frequently displaying stunning intricate patterns in white, cream, yellow or blue.

The most common form of boulder opal is "seam boulder opal" also called "vein boulder opal", when irregular natural opal seams (from millimeters to centimeters thick), run through the matrix host rock (*Discover Opals: Before & beyond 2000 with surface indications*, by Stephen Aracic, 1996). When this material is cut, the opal layer rests on the ironstone layer, usually creating two visually distinct layers.

Matrix opal forms when very thin natural opal seams are penetrating the entire host rock (matrix) and become a mixture of opal and ironstone, often creating dazzling patterns. That type of opal is furthermore accurately referred to by Downing and Aracic as "boulder matrix opal". (Downing, 2003; Aracic, 1996). They both use the term boulder matrix opal in order to differentiate it from the other matrix opal, found in Andamooka, Australia, which is a fine-grained opal mixed in throughout the entire host rock, instead of seams running through.

All the boulder and boulder matrix opals are found in the state of Queensland, Australia. Several of the various locations produce very distinct patterns, which are identified by the location prefix, such as Yowah opal, or Koroit opal.

## BOULDER OPAL

Boulder opal was first found in the "arid regions of western Queensland" around 1869, according to Len Cram, the world's most respected opal author (*Beautiful Boulder Opal*, Kingswood Press, 2003). Len has written many books with historic

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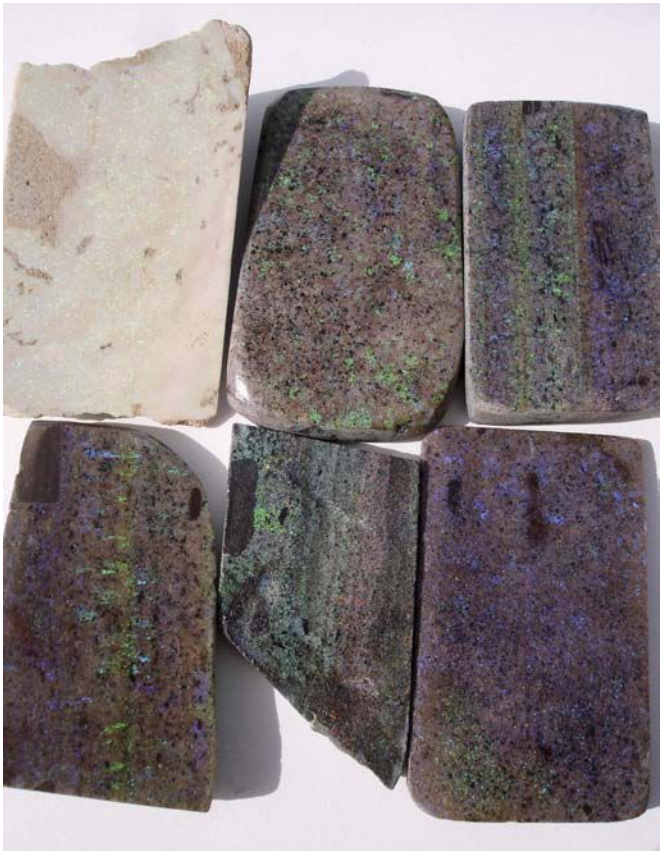
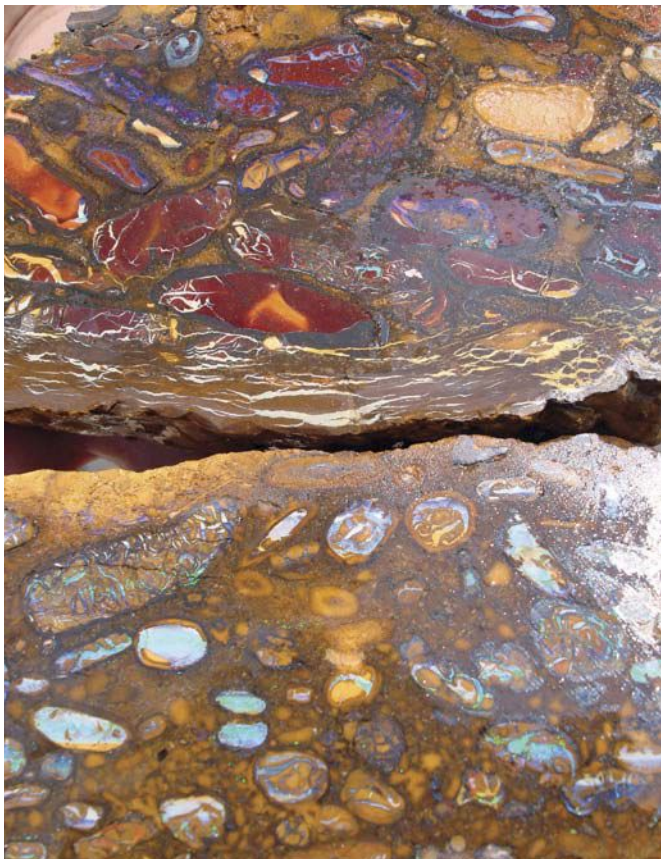


HELEN SERRAS-HERMAN PHOTO

**The pinfire of Andamooka matrix opal is very bright, but the matrix is too pale, so it is usually treated to make it look like black opal.**



HELEN SERRAS-HERMAN PHOTO

**Sometimes, very small nuts of various shapes and sizes, filled with "jelly" opal and great play of color, form a Yowah opal conglomerate.**

information and superb photos of opals. Among them, his four-volume book series *A Journey with Colour* is now a rare collector's item; I am lucky enough to own a set.

In his books, Len uses adjectives like "beautiful", "exquisite", "queen of gems", and "lovely" to describe boulder opal. I would agree and probably add some more, such as "unrivaled", "remarkable" and "striking".

The deposits are found in weathered sedimentary rocks from the Cretaceous age (about 100 million years ago). The town of Quilpie is called the "home of boulder opal", and more opal fields extend up to Opalton to the north (*Opals*, Fred Ward, 2000)

Opal penetrates the ironstone host matrix, which is commonly a combination of aluminum oxide, silicon dioxide, and iron oxide, and forms in jagged seams. Sometimes the seams are a couple of inches thick, and other times they may be only millimeters thin.

When the precious opal covers the entire face, it is called "full-face boulder opal", according to Barbara McCondra's book *Fire in a Plain Brown Wrapper* (2005). Paul Downing calls it "clean-face boulder opal" (*Opal Identification & Value*, Majestic Press Inc., 2003), and Allan W. Eckert uses the name "solid opals" (*The World of Opals*, John Wiley & Sons, 1997). No shortage of terminology here!

Although full-faced opals are considered of higher value, some cutters will purposely leave some of the matrix showing on the face of the opal cab so that the buyer knows that the material is natural and not assembled. "Slight marks and protrusions of ironstone are fairly typical," says Damien Cody in his book *The Opal Story* (Andrew and Damien Cody, 2008).

## MATRIX OPAL

The best-known matrix opal material comes from the Andamooka area in the state of South Australia. This natural matrix opal is a fine-grained opal mixed throughout the entire light-colored limestone matrix.

The pinfire of Andamooka opal is very bright, but the matrix is too pale; therefore, it is usually treated to make it look like black opal, which is considered the most valuable opal. There are two types of treatment: In smoke treatment, opals are wrapped in paper or sand and then heated (*Exotic Gems*, Vol. 3, International Jewelry Publications, 2014). The other type, carbonization, is carried out by burning the opal with sugar and sulfuric acid. The Andamooka matrix opal material is rather porous, allowing for successful treatment.

This matrix opal was originally called "mother opal" by the opal miners, but the term "Andamooka opal" has replaced it over the years (*Opal Buyer & Dealer Handbook*, by Emory W. Liggett, Tops in Opals, 2000). The carbonization treatment is also referred to as "cooking", and the resulting material as "treated" or "dyed" opal, even though no real dye is involved.

Another natural matrix opal material comes from Honduras. Some material comes in thick seams, while most of the Honduras opal is embedded as small pinfire flecks in black basalt (Downing, 1992). The volcanic origin host rock—the black basalt—is rather soft, and polishing this material may be somewhat difficult due to uneven hardness within the rock.

An additional type of matrix opal is the Mexican matrix opal, which is orange-red fire opal that often has brilliant play of color encased in rhyolite matrix. This material is fashioned into cabochons, eggs, spheres and carvings, often with the matrix surrounding the fire opal in the center.

One more North American matrix opal hails from western Louisiana. It was mined at the basal Fleming Formation of Vernon Parish, and it is called Louisiana opal, or Louisiana sand opal. The sandstone grains are naturally cemented together by clear, precious opal. Most of the material shows a brown base color, but it also occurs in gray to black (http://geology.com/gemstones/states/louisiana.shtml). Some of it shows spectacular blue/green fire.

The Louisiana opal is usually stable enough to be slabbed and cut into cabo-

HELEN SERRAS-HERMAN PHOTO

**The "flame" patterns in Koroit opal are unique, so they can be used to identify the material's origin.**

chons, carvings and spheres. The material was discovered in the early 1900s, but it was kept a secret until a claim was filed for the Louisiana Opal Exchange mine, also known as the Hidden Valley Opal mine, which only operated from 1989 to 1993 (*Opal: the Phenomenal Gemstone*, by Si and Ann Frazier, Lithographie LLC, 2007). It is very difficult to find Louisiana opal material on the market today.

## BOULDER MATRIX OPAL

There are several locations in Queensland that produce boulder matrix opal, and each one is almost identifiable by the formation and patterns in the opal. Frank Leechman gives a great definition of boulder matrix opal as "dark chocolate-brown stone riddled with cracks which show beautiful and brilliant opal colors" (*The Opal Book*, Ure Smith, 1961).

Barrie O'Leary says, "myriads of tiny cracks have developed [in the ironstone] in a three-dimensional network, and into them veinlets of brilliant flashing opal have been deposited" (*A Field Guide to Australian Opals*, Gemcrafty Pty. Ltd., 1977) offers a precise assessment of the visual structure of boulder matrix opal.

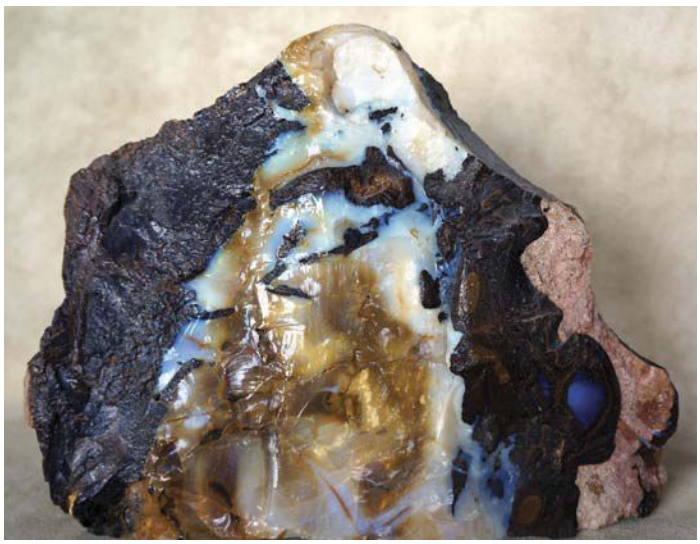
One of the oldest boulder matrix opal-mining locations, and probably the most famous one, is Yowah (pronounced Yá-wa), in southern Queensland. The first registered lease of a field there was in 1884. The name, probably of Aboriginal origin, reflects the nearby Yowah Creek. (*Beautiful Yowah & Koroit*, by Len Cram, Kingswood Press).

Cunnamulla, in the south, and Winton, in the north, are the closest towns to the famous mining areas of Yowah, Koroit and Maynside. Queensland is described as the real Outback, famous for its isolation and remoteness. There are a few year-round miners and many "fossickers" (rockhounds) that stay in the fields for a few days or weeks in temporary housing, like tents, campers, or old buses.

Mining is labor-intensive in the arid desert. Shafts and tunnels are dug, and automatic hoists are employed to bring the material to the surface. Digging is usually done with picks or power tools, such as electric jackhammers. Old claims are re-worked, and tailings are processed again through a rumbler, which is like a barrel tumbler.

HELEN SERRAS-HERMAN PHOTO

**The precious opal in the Koroit material is mostly near the outer skin of the concretion, and usually has to be ground down to the layer of fire.**



HELEN SERRAS-HERMAN PHOTO

**Boulder opal is found in the arid desert of the Australian Outback. This large specimen measures 10 inches wide by 8 inches tall and displays beautiful color patterns.**

The Yowah material is typically found as nodules or concretions, some complete balls and some partials. They are known as "Yowah nuts", even though they are not organic. The nuts formed together in a band at the junction of clay and sandstone (Aracic, 1996). The opal is known as Yowah opal.

Yowah nuts are customarily cracked open in the field, in order to see what's inside. It is much faster to hit them with a hammer, even though some nuts are damaged that way, than to cut them on a saw. When they reach us, the American buyers, they almost all have conchoidal fractures from being hit with the hammer.

It is a major treasure hunt: Are the nuts worth thousands of dollars or are there worthless vugs inside? It all depends on the presence of precious opal veins and its patterns, colors and intensity. Yowah nuts may be filled with the most valuable black crystal (transparent) opal or light crystal opal, and worth six-figure dollar amounts.

There are spectacular Yowah opals that rival the famous black opals from Lightning Ridge, Australia. As with all black opal, the value rises when red flashes are present. The center of the nut may show a kernel of precious opal, common opal, a fine white powder, a loose kernel, or it can be hollow and have no kernel (*Australian Opals in Colour*, N. and R. Perry, Reed Pty Ltd, 1969). The nuts may just have some color layers and holes and no opal inside. Miners crack hundreds of worthless Yowah nuts until they find the valuable ones.

Those valuable nuts are usually then sliced in order to display circular and concentric patterns. Typically, there are bands or layers of precious opal alternating with very hard, burgundy-red, siliceous ironstone, which is hard like jasper and takes a very high polish. Sometimes, bright-yellow and -orange lines are in between those bands. The limonite and hematite bands also add to its beauty.

Occasionally, the kernel is filled with white common opal, along with other ironstone inclusions, resulting in wonderful "images" in the Yowah stones. There are Yowah opals that are famous for their "pictures" (*A Journey with Color*, Vol. 1, by Len Cram, Kingswood Press, 1998). The value of those stones is always higher.

Sometimes, very small Yowah nuts of various shapes and sizes, filled with "jelly" (clear) opal—often purple in color, and some with great play of color—are arranged haphazardly in the mudstone, forming a conglomerate or breccias. Rod Griffin, of Rod Griffin Boulder Opals, one of the pioneering Aussie boulder opal dealers, has displayed some gigantic and stunning Yowah conglomerate sculptures at the Tucson gem shows. Huge pieces of opal conglomerate have come out of Yowah and Koroit and been sold by another terrific opal dealer and friend, the late Peter MacKenzie, of McOpal.

About a decade ago, I purchased a wonderful opal parcel with material referred to as "chocolate opal". It came from a location about three miles outside of Yowah. It is boulder matrix opal that has brightly colored, fine opal veins in what the opal miners call the "biscuit band" (flaky sandstone). The material can produce some fabulous cabs and carvings, but it is really hard to work with, as the opal seams are very thin and can vanish in a flash while grinding, and some of the matrix is too soft.

Another unusual boulder matrix opal parcel that I purchased a long time ago was material from Winton, in the northern part of Queensland. That material is believed to be opalized wood limbs and shows bright rainbow flashes all the way through the matrix. The town of Winton is known for the ballad "Waltzing Matilda", which Banjo Paterson wrote there in 1895.

Less than 200 kilometers away from Yowah is Koroit. The first opal was discovered here in 1897. Until a few decades ago, boulder matrix opal material from Koroit was hauled down to Yowah, which was better known, and sold as Yowah opal (*Koroit Ironstone Matrix Opal Cutting Tips*, by Barbara McCondra, 2001). It has probably only been in the last 10 to 15 years that Koroit has come strongly into the market with its own identity. Both underground and open-cut mining is done in Koroit using excavators and bulldozers.

HELEN SERRAS-HERMAN PHOTO

**Hundreds of boulder opal pieces are used in this stunning, 6-foot tall fountain, seen at the 2010 Tucson gem show. (Rod Griffin Boulder Opals)**

M.J. COLELLA PHOTO

**Yowah nut opals are usually sliced to display circular and concentric patterns, as in my 14k gold earrings set with Colombian emeralds.**

HELEN SERRAS-HERMAN PHOTO

**The curlicue opal veins in this Koroit opal, part of my Omphalos of Earth gem sculpture, are like decorative calligraphy script in the dark chocolate-brown ironstone.**

HELEN SERRAS-HERMAN PHOTO

**The Yowah opals, or "Yowah nuts", typically form as nodules or concretions.**

A wonderful opal dealer, the late Barbara McCondra, described the opal veins in Koroit opal as "lines that look like blades of grass blowing in the wind", while Fred Ward called them "colorful swirly almost liquid patterns" (*Opals*, Gem Book Publishers, 1997). I personally love the zigzag and "flame" patterns, and think that Koroit opal is like a spectacular fireworks display!

## LAPIDARY TREATMENT

Cutting boulder opals depends a lot on the lapidary. The balance of ironstone and opal is a design element that should be carefully considered. One can create classic oval and rectangular shapes, geometric patterns, asymmetrical, or free-flowing organic designs that capture the essence of the stone.

When the seams in boulder opals are thick enough, they are commonly split, creating matched-pair half splits with almost mirror-image patterns. The common practice is to stick a chisel or a screwdriver into the seam, hit it with a hammer, and split the stone apart, but I am always afraid of messing up the piece by breaking it into many pieces. I would rather purchase it already split.

If the band of play of color is deep enough to be ground down, boulder opals are cut, sanded and polished. When the uneven faces of the split boulder opals are too thin and almost impossible to sand and polish, their surfaces are often left in their natural state and they are sold as collector's specimens, or they are covered with epoxy.

When cutting full-face boulder opal (the ones where the precious opal covers the entire face), treat the top surface as you would any other opals: sand up to 3000 grit and then polish with cerium oxide.

For me, cutting boulder and boulder matrix opals is a "love-hate relationship". I love the finished stones, but I hate how all the machinery gets covered with the red-brown, rustlike mud. My husband, who is fond of cutting this material, cleans all the machines meticulously at the end of each day every time he cuts these opals. Peter once showed us his boulder opal-cutting attire: a plastic apron that covered him from neck to toe! If that red, iron-containing matrix stains your clothes, it is almost impossible to wash out.

Working with the Yowah opal nut material is probably easier than boulder or Koroit opal, as the slabbed Yowah nuts retain their concentric pattern, hopefully with some good precious opal in the center. They may be cabbed with a dome or as flat disks.

Some of the ironstone matrix, both in Yowah and Koroit stones, has higher iron content and possibly more silica. If you gently tap two stones together, they make a ringing sound. That material is hard and polishes to a mirror finish. Other material may just finish to a glossy surface, and some may be almost impossible to bring to a shine. But don't worry, that adds a wonderful texture to your cab or carving.

The precious opal in the Koroit material is mostly near the outer skin of the concretion, and usually has to be ground down to that layer of "fire". Some cutters spend a lot of time grinding the rough, ferruginous outer sandstone rind until the play of color layer is reached. That procedure is known as "skinning" the opal and was the preferred method for Dale Davey, another great opal cutter and dealer who has left us. Grinding that skin away using a rough 80 grit diamond wheel and quickly removing huge amounts of mud is probably the dirtiest part of the entire process. It is best to use a trim saw to cut off any unwanted material and to cut your flat base.

I often like to work with the exposed surface of the Koroit opals, making them into the top of a cab or carving. I can see the opal veins instead of grinding away muck in the hopes of finding the elusive, scintillating opal layer. Koroit opals are also more frequently cut as freeform cabochons, following the designs and patterns of the stone.

When cutting boulder matrix opals, complete your grinding steps and then follow the sanding sequence of 600, 1200 and 3000 grit, with the additional 8000 and 14000 grit steps. Finish the polishing with 50000, or even better, with 100000 diamond.

Some material inside the Koroit matrix opal nodules is called "maggoty" (looking like being infested and partially eaten by maggots), with holes or jagged surfaces, but the designer lapidary can incorporate these into the finished surface and create unique designs. I am always an advocate for getting maximum yield from the stone and love including unique elements in the design of the stone.

The popularity of boulder opals and boulder matrix opals has increased in the recent decade, embraced by jewelry designers and collectors alike. The finished stones are like no other gemstones.

*Helen Serras-Herman is a gem sculptor and jewelry artist with 30 years of experience. She was inducted into the National Lapidary Hall of Fame in 2003. See her work at www.gemartcenter.com.*

## Show Dates *from page 33*

prizes. See and buy gems, minerals, beads, metaphysical stones, fossils and much more from all over the world. Scouts can earn merit badges from a mineral gemologist to assist with identification and requirements. Demos include cutting cabochons, faceting gems, wire wrapping, flint knapping and metal work. Adults $5.00, Students $2.00, Scouts free. Free Parking. ; contact Paul Hayes, 1400 Sawyerwood Ave, Orlando, FL 32809, (407) 816-1229; e-mail: phayes3@cfl.rr.com; Web site: www.cfmgs.org

**11-13—TOLEDO, OHIO:** Annual show; Toledo Gem and Rockhound Club, Stranahan Great Hall; 4645 Heatherdowns Blvd.; Fri. 2 pm-8 pm, Sat. 10 am-6 pm, Sun. 11 am-5 pm; Adults $4, Seniors $3.50, Students $3.50, Children under 12 free!; Active Military with ID and Scouts in Uniforms are Free, Exhibits, Lapidary and Jewelry making demonstrations, scholarship raffle, free kids' mineral kits, dealers, club sales; contact Stephen Shimatzki, 4295 County Rd. 16, Woodville , OH 43469, (567) 868-8794; e-mail: sjs132@gmail.com; Web site: www.rockyreader.com

**11-13—WINSTON-SALEM, NORTH CAROLINA:** Annual show; Forsyth Gem And Mineral Club, Education Building, Winston-Salem Fairgrounds; Enter Gate 9 from 27 th Street; Fri. 10:00 am- 7:00 pm, Sat. 10:00 am-7:00 pm, Sun. 12 noon-5:00 pm; Adults $3.00, Students K-12 Free; Activities; Gold Panning, Geode Cutting, Grab Bags and Mineral Identification.; contact W. A. Marion, 1163 Bear Creek Church Road, Mocksville, NC 27028; e-mail: mariona1@yadtel.net; Web site: www.forsythgemclub.com

**12-13—HANFORD, CALIFORNIA:** Annual show; Diggin'sproductions , Hanford Civic Center; 400 N. Douty St; Sat. 10:00 am-6:00 pm, Sun. 10:00 am-6:00 pm; Adults $2.00, Children are Free!; Rock, minerals, slabs, fossils. Demonstrations, Jewelry; contact Kathy Corbett, 341 cedar st., Hanford, CA 93230, (559) 904-4795; e-mail: Corbett1@sbcglobal.net; Web site: Digginsproductions.com

**12-13—PORT ANGELES, WASHINGTON:** Annual show; Clallam County Gem and Mineral Association, Vern Burton Community Center; 308 East 4th Street; Sat. 9 am-6 pm, Sun. 10 am-4 pm; Admission is Free!; contact Jennie Bourassa, PO Box 98, Sequim, WA 98382, (360) 681-0372

**12-13—NORTH ADAMS, MASSACHUSETTS:** Annual show; Northern Berkshire Mineral Club, Eagles Hall; 515 Curran Highway; Sat. 10 am-6 pm, Sun. 10 am-4 pm; Adults $4, Seniors are Free, Students are Free, Children are Free; The show will feature choice minerals, gems, jewelry, gifts, geode cracking, gem panning, door prizes and refreshments.; contact Larry Michon, 385 West Main Street, North Adams, MA 01247, (413) 663-8430; e-mail: lmichon@rcn.com

**12-13—WALLA WALLA, WASHINGTON:** Annual show; Marcus Whitman Gem and Mineral Society, Walla Walla County Fairgrounds; 363 Orchard St; Sat. 10 am-5 pm, Sun. 10 am-5 pm; Adults $2, Children are Free; contact Jack Edwards, (509) 529-3673; e-mail: jcedwards1475@yahoo.com

**12-20—DENVER, COLORADO:** Annual show; Eons Expos, LLLP, Denver Coliseum; 4600 Humboldt Street; Sat. 9 am-6 pm, Sun. 9 am-6 pm, Mon. 9 am-6 pm, Tue. 9 am-6 pm; Admission is Free; Come see 250 dealers on both levels of the Denver Coliseum plus in 100 tent spaces outside. It's all here: fine minerals, fossils, meteorites, gems, artisan jewelry, gold, silver, lapidary, beads and rough — split evenly between wholesale and retail. Running from Sept 12 - 20, this is Denver's only weekend-to-weekend show and attracts 18,000 visitors of those nine days. With 2,000 tables covered with earth treasures and free parking for 1,500 cars on the 33 acre complex, this is America's largest mineral, fossil, and gem show. The low booth fee and aggressive advertising ensures that the show continues to grow 20% a year. Meet the cast of the TV show 'Prospectors' who will be at the show selling their finds. Peruse the dinosaurs on display. Ogle museum-quality sculptures in sold blocks of clear quartz. Take home a piece of the Moon. Select specimens found in only one place on Earth, being offered by the mine owner herself. Prices range from just $1 to $1 million. Free Parking and Admission! ; contact Heather Grana, 235 First Avenue, Keyport, NJ 07735, (973) 903-3256; e-mail: Heather@EonsExpos.com; Web site: http://ColiseumShow.com

**13-20—DENVER, COLORADO:** Wholesale and retail show; Martin Zinn Expositions, L.L.C., Ramada Plaza Denver Central; 4849 Bannock St.; Daily 10:00 am-6:00 pm, Sun. 10:00 am-5:00 pm; Admission is Free!; Two hundred retail and wholesale dealers from around the world offer minerals, fossils, gems, jewelry, beads, meteorites, and decorator items. Over 30 years in the same location, this is Denver's longest-running satellite show, with the best dealers and the best buys.; contact Regina Aumente, PO Box 665, Bernalillo, NM 87004, (505) 867-0425; e-mail: mzexpos@gmail.com; Web site: http://www.mzexpos.com/colorado_fall.html

**18-20—SAN RAFAEL, CALIFORNIA:** Wholesale and retail show; Gem Faire Inc, Marin Center; 10 Avenue of the Flags; Fri. Noon-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Admission is Free!; Fine jewelry, precious & semi-precious gemstones, millions of beads, crystals, gold & silver, minerals & much more at manufacturer's prices. Exhibitors from around the world. Jewelry repair & cleaning while you shop. Free hourly

*continued on page 70*

Rock&Gem

# KIDS

Synthetic Rocks:

## Fordite

My son, a former pebble pup in the Ventura Gem & Mineral Society, works for the Ford Motor Co. While visiting him in Michigan, we toured The Henry Ford museum where, in the gift shop, we found jewelry featuring colorfully banded cabochons. These cabs came not from agates, but from decommissioned car factories!

In days of old, car manufacturers had paint rooms, where paint was sprayed onto cars by hand. Cars were rolled in on skids, and different colors were sprayed onto each. As paint was sprayed, the excess dripped down onto the skids and pooled. The cars were then "baked" to cure, or harden, the enamel. Over time, dozens of layers of colors built up around the skids.

When old factories were decommissioned, some enterprising souls discovered the caked layers of cured paint and learned that it could be cut to reveal colorful banded patterns similar to banded agate's. The material, which came to be called fordite, is lightweight, with a rubbery feel, and there's no mistaking that it's paint when you cut and polish it—the paint fumes almost knock you over!

The price will knock you over, too. At the gift shop, tiny specimens in cufflinks were going for $250 and earrings for $100. I bought a small piece of "rough slag" at a gem show for $35. Fordite—also called Paintrock, Motor Agate, and Detroit Agate—is described by the museum as "Recycled, Repurposed and Cool".

Today, cars are painted by robots via an electrostatic process that leaves no overspray, so fordite is an endangered "rock" available in limited supply, which accounts for those high prices. Get it while it lasts!

*—Jim Brace-Thompson*

Organic Gems:

## Ivory

Although most gems come from minerals, which are inorganic, there is a class of "organic gems", plant and animal materials that are used for lapidary purposes. In recent years, one of these has become notorious because of the manner in which it's obtained.

Ivory is the stuff of elephant tusks and the teeth of certain whale species. Whale teeth were a byproduct of the whaling industry when oil derived from whale blubber was burned in lamps. To while away the hours of long sea voyages, sailors carved or engraved scenes into the teeth in an art form called scrimshaw.

Elephant tusks have served many ornamental purposes, such as piano keys, buttons, carvings and jewelry. However, the slaughter of large populations of elephants and whales just for the purpose of harvesting the ivory has heightened awareness of the need for wildlife conservation. The United States banned whaling in 1972. More recently, in February 2014, the White House unveiled a National Strategy for Combatting Wildlife Trafficking, which prohibits commercial sale or resale of elephant ivory in this country, except in the case of bona fide antiques (at least 100 years old).

Today, artists generally carve fossil ivory from ancient walrus or mammoth tusks. Much of this comes from Alaska and Siberia. They've also turned to sustainable ivory substitutes like tagua nut. For scrimshaw, folks use beef bone or antlers shed naturally by deer, moose and elk.

VIA WIKIMEDIA COMMONS

**Scrimshaw in whale tooth**

*—Jim Brace-Thompson*

Special Effects:

## Dendrites

Many people mistake dendrites on rock slabs for fossil ferns or other leafy, branching fossilized plant remains. While they may look like fossils, dendrites are actually special mineral growths with an arborescent (treelike) pattern that gives them an organic appearance. In fact, the word "dendrite" comes from the Greek word *dendron*, meaning "tree".

During "equilibrium conditions", most mineral crystals grow slowly and uniformly across their surfaces, gradually increasing in size. Dendrites tend to form during non-equilibrium conditions, when faster rates of crystal growth cause crystals to branch out rather than grow uniformly in one direction. During such periods of quick, unstable growth, the branching process can repeat. The result is known as a dendrite.

Dendrites can form within or on the surface of other rocks or minerals or as free-standing, three-dimensional structures. Those that form within fractures or bedding planes in sedimentary rocks like limestone or shale often consist of manganese oxides. These were left behind when manganese- and iron-rich water flowed between the layers. These two-dimensional dendrites are most often confused with fossil plants.

Three-dimensional dendrites can form within cryptocrystalline quartz, forming moss agate. Some free-standing minerals, such as copper, may also grow in three-dimensional, branching structures. You can even see dendritic growth patterns in ice crystals, like frost patterns or snowflakes.

*—Jim Brace-Thompson*

**Manganese dendrites on shale**

## Crack the Code

Find out which American states dinosaurs once called home. Fill in the grid as you figure out which letters match the code letters. (Example: Code letter C = A)

| A | B | C | D | E | F | G | H | I | J | K | L | M | N | O | P | Q | R | S | T | U | V | W | X | Y | Z |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| C | | | | | | | | | | | | | | | | | | | | | | | | | |

A
G P I Z E C Q H X Z E E P N M Z I U E C I G

A A A
B H C J A E J C I M U X Z Q I G P I J Z N Z H C G Z

A A
J Z I I U J B P J Q B O C E E C J L Q E U B B E

A A
O Z I B C I C I U S K U H E U T I U S O U F P J Z

A A A A A
Z A N C L Z O C E Z Q B L G C A Z B C B U F C E

A A
C I G Q B C L

THINKSTOCK.COM

# Rock&Gem

## SHOWCASE

# Rock&Gem

## SHOWCASE

# The Pendleton Quarry

As the result of over 20 years of blasting operations, this drill hole has moved 6 inches laterally along a shale layer.

## Calcite Collecting Near Indianapolis

Story and Photos by Mark Leatherman

It was a cold February morning in Indiana when I visited a colleague of mine, Dr. Nelson Shaffer, to ask some questions about joining the Midwest Chapter of Friends of Mineralogy, of which he was an executive officer. As I entered his office, I was presented with an impressive flat of iridescent calcite crystals on matrix that he had just acquired. I nearly salivated like a Pavlovian dog over his flat of multicolor crystals and asked the obvious question: "Where did you get these?"

**The two partial benches in the foreground were where the majority of collecting took place.**

**The first "gem of a find" for the day was this wonderful, transparent, honey calcite rhomb that Josh found.**

I anticipated that he would mention a very hard-to-access location or keep it a secret, but to my surprise, he told me they were from the Pendleton Quarry, just northeast of Indianapolis. I remembered that the Indianapolis Gem, Mineral & Jewelry Show was approaching in late March. Knocking out two birds with one stone immediately came to mind!

I got in touch with quarry geologist Rick Lucas, of Irving Materials Inc. (IMI), about arranging a visit. As long as I was with a small group, he said, we could come at nearly any time during a weekend. The only requirement was that we bring our own tools, heavy boots, and hard hats.

The weekend of the Indy show arrived, and all the snow melted right on schedule! Originally, four people had planned to take the trip, but two had to drop out due to illness and a sudden schedule conflict. Therefore, only a fellow graduate student, Josh Field, and I made the hour-and-a-half trek up north toward and around the capital city. We arrived at the IMI parking lot and were greeted by two other people, waiting in their car, who said they are friends of Rick's.

After a brief wait, Rick pulled up in his truck, exchanged pleasantries, and had us sign the compulsory liability paperwork. We packed into two vehicles, and as we drove along the pit roads, Rick gave us the general geology tour en route to the main collecting area.

The central Indiana area is dominated by Devonian and Silurian carbonates and shales. The specific units that are exposed at the Pendleton quarry, near the town of Anderson, consist of a Silurian sequence of Mississinewa shale, Louisville limestone, Waldron shale, and Salamonie dolomite. The sequence is capped off by Middle Devonian-age Jeffersonville limestone. We were not able to go into the deepest parts of the quarry, where the Silurian rocks are, but I have heard reports that rostroconch clam and gastropod fossils can be found here, and that rare trilobites can be found in the Salamonie dolomite.

The stratigraphic sequence is a classic example of alternating marine conditions in the continental interior, from deep-water environments (favorable for shale/mud deposition), to shallow depths which sufficient sunlight is able to penetrate (favorable for limestone/dolomite deposition). Much of the continental interior would experience these marine fluctuations for another 60 million years or so until the onset of the Carboniferous period, when swampy conditions would predominate, giving rise to most of our coal resources.

Just before we hit the collecting area, Rick stopped near a large stone crusher and asked if we noticed anything unusual about the quarry wall in front of us. It took a second, but to my amazement, I saw a drill hole marking that appeared to be very slightly offset, presumably due to an earthquake. I knew that some seismic activity could be expected in southwestern Indiana, which hosts the Wabash Valley fault system, but I started to scratch my head, since we were smack in the middle of the state.

Then Rick imparted some new quarry geology knowledge. Though scientists are

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not 100% positive, they surmise that this quarry has been in operation for such a long while that continuous blasting may have produced some slight movement along a shale seam, especially when the rock was wet.

We parked near the southwest edge of the quarry outline, our starting point for picking. We were instructed that we could also venture onto the next bench down, but that would be the vertical limit of where we could safely explore. I started toward the quarry road that gently slopes to the next bench, while Josh and the others elected to scan the area away from the bench, behind where we had parked. It had not even been five minutes before I spotted some palm-size, characteristic rhombohedral crystals of clear and slightly honey-hued calcite, scattered all over for the picking!

I soon ended up with three separate collection piles in this area alone that marked spotty areas with great crystals, since it is easy to lose track. After a few minutes, Josh started to get the hint that I happened to stumble upon the better initial area! I asked if he'd had any luck, and while he had not fared as well quantitatively and specimen size-wise, he had found a smaller calcite rhomb that was perfectly transparent and displayed a sunny golden sheen, almost reminding me of a heliodor beryl crystal.

Most of my rhombs, up to that point, were translucent (at best) and had a healthy amount of "rust stains". After Josh started to look around my area, I noticed Rick and the others were starting to head down-bench and I elected to follow and leave my piles behind for now.

On the lower bench, we mostly searched for crystalline vugs in the bench wall. I remembered from looking at Dr. Shaffer's iridescent samples beforehand that this calcite variety was mostly in harder dolomite matrix, so moving down-bench from the Jeffersonville to the Salamonie formation seemed to be the logical way to go for my most desired prize. I have heard from Rick that the largest-ever observed masses of calcite were a foot in diameter, and the largest "dogtooth"-habit crystals were up to 8 inches long! As a potential bonus, sphalerite (ZnS) has also been documented to occur with the massive form of calcite.

Right away, I started to spot multiple smaller vugs of excellent drusy crystals. However, given the harder nature of dolomite, I kept on going until I could find a vug of worthy size for hammering as to not wear myself out before the rock show! As I stayed closer to the bench wall, I started to see Josh almost walk parallel to me, but closer to the bench edge. I jokingly said, "I think we'll have better luck on the wall, if these vugs are any indication," to which he replied, "I know, but I found this on the downslope part of the trail close to the edge." He had managed to find a small, three-dimensional, free-floating trilobite near the edge, which explained his reason for staying close to it!

**Dogtooth dolomite crystals in dolostone vugs are not hard to find here, but can require a bit of effort to extract! Specimen is 6 inches across.**

**Both amber and white "eggs" of calcite were found on taller tailing piles near the quarry's edge. The longest one measures 7 inches across.**

Not being as much of a fossil person, I stayed on my course, hugging the walls. I did start to see some larger vugs, but now the next question became, "Which ones would be the most worth banging on?" I ultimately chose one that had some faint fractures in the host dolomite, in which I could start chiseling, and displayed some sub-centimeter euhedral crystals with some milky iridescence.

It was not until after I successfully chiseled out the matrix specimen that I realized that the crystal angles were steeper than I had thought. The crystals were somewhere in between rhombs and cubes—it did not take long for me to recognize them as dolomite. The extra magnesium cation ($Mg^{+2}$) being added to the calcite crystal lattice slightly distorts it, so that cleavage planes are shifted from the characteristic 120° angle closer to (but not quite) 90°. I had mixed feelings about this particular find, since I had not expected to find dolomite, but it did not have the deep degree of "oil slick" iridescence that I really desired.

However, a few more paces along the bench, my luck started to change, albeit in a different way! The path started to curve away from the edge, and I was heading toward a tall rubble pile that reached nearly as high as the first level we were on.

Farther on down the line of piles, I saw one of Rick's friends already investigating, so I concluded that they were safe to hunt on. Not long after I followed suit, the number of my treasure piles, which had I started near our vehicle, sharply in-

**This smaller amber calcite is a prime example of cool, fine, parallel lineations that really make the crystals pop out.**

**The iridescent character of this specimen is perhaps attributed to cloudy inclusions in calcite.**

creased as I started to find boulder after boulder of white and dark honey-colored calcites. The biggest one I found was almost a foot long and most of them had a thin, but tough, sandy layer on their surfaces.

I then started to find rather nondescript boulders and cobbles that had just a patch or two of milky white or caramel hues. That is when I started to go to town, for the first time on the trip, with my hammer and chisels. More often than not, I would crack these rocks open to reveal many "eggs" of pure, lustrous calcite.

Not long after hearing my exclamations of joy, Josh started to ascend the spoils piles at a higher level than my jackpot area to try his luck. After some poking around and finding a few "eggs" of his own, he called out to me, asking how hungry I was getting. After ignoring my grumbling stomach over my lucky hammering streak, I admitted that we should take a break and eat soon. We all started to make our way back to the truck, while collecting our scattered keep piles along the way.

Rick then asked if we could spare a short block of time to investigate some till boulder piles on the way back to the entrance. Upon hearing "till piles", Josh perked up and, without missing a beat, said, "Oh, yes!"

Admittedly, I have only sparingly hunted on till piles, since I never seem to find anything, but I decided to take one for the team, as they say. Little did I know that I would shortly be thanking Josh for his idea.

It did not take Josh even 10 minutes—and 20 minutes for me—to find pyrite concretions encased in thin shale amongst the short, random piles. After a brief inquiry from Rick, we noticed that we had picked up specimens from the New Albany shale which, in turn, is known in the area for producing spheres and concretions of nearly pure pyrite. (As a brief aside, pyrite balls can be found in quarries dotted in and around Indianapolis, as well as in New Albany shale outcrops, near the Ohio River at the town namesake of New Albany.) Neither of us could wait until we got back to our department, so we could saw our newfound gifts in half!

That find was all it took for us to be satisfied at our last stop, and we proceeded back to the entrance. After graciously thanking Rick and his two cohorts for their hospitality and wonderful conversation, we drove only 20 minutes southwest to the Indianapolis show for the remainder of the afternoon.

As of the time of writing, the company was setting aside weekend dates during the summer for collecting at several of their properties, alongside Pendleton. For more information regarding specific dates and accommodations, e-mail Rick Lucas at rick.lucas@irvmat.com. Make sure to bring a hardhat, steel-toed shoes, safety glasses, and your favorite rockhounding tools. The only other requirement prior to collecting is to sign a brief safety waiver upon arrival.

The Pendleton quarry is a highly recommended place for calcite collecting on a weekend for the ease of finding crystals in a wide range of sizes, colors, and crystal habits, not to mention the conveniences of being in a metropolitan area.

# WHAT TO CUT

by SCOTT EMPEY

## Guadalupe Poppy Jasper

California is famous for its poppies; in fact poppies are California's official state flower. We have a Poppy Week and even a Poppy Day, but the poppies I like the best are the ones in the colorful poppy jaspers found in the state.

The best-known poppy jasper is probably Morgan Hill jasper, found near the city of Morgan Hill (Santa Clara County), in Northern California. Guadalupe jasper, found only 15 miles away, is a close cousin. Several other varieties are found throughout the region's foothills and mountains.

Poppy jaspers are "orbicular" jaspers, which means they contain spherical structures called "orbs". When the jasper is slabbed, the orbs appear as round or elongated bull's-eye shapes that can resemble flowers—not really like any poppies I've seen, but flowers for sure.

The California poppy jaspers are found in the Franciscan formation. They are a type of iron-rich silicated chert that resulted from ancient seafloor sediments laid down during the Late Jurassic and Cretaceous periods. Don Kasper, who has written several books on the formation of agates and jaspers, has done studies on poppy jasper using microscopy and infrared spectrometer analysis. Don has found that the poppies themselves are actually radiolaria, the fossilized silica skeletal remains of aquatic phytoplankton.

Don states that the size of the poppies depends upon the species of phytoplankton and how many sedimentary layers are preserved in the rock. The very fine orbs of Guadalupe jasper are the preserved radiolarian nuclei.

If you would like more thorough information on Don's studies, you can find his books on Amazon.

Guadalupe poppy jasper generally has smaller, tighter, and better-defined poppies than some of the other varieties. The Guadalupe jasper seems to have fewer fractures than the Morgan Hill material, and they tend to be healed, or re-agatized, into a more solid and stable state. It has beautiful, bright colors. In many cases, the centers of the poppies are white, but the outer rings and the background are much more colorful.

The classic Guadalupe arrangement is white orb centers and red rings against a yellow background, but some of it gets really wild, with red, yellow, green, blue, and even pink in the mix.

Most—if not all—the sites for collecting this material are exhausted or on private property, but a fair amount was collected while the getting was good. Nowadays, you can find pieces in old collections or on eBay or other online sources. Generally, it is not cheap, but there is usually some available; good slabbed material usually runs from $5 to $10 for a piece that you could cut a nice cab from.

Poppy jasper is generally a breeze to cut, as it is relatively soft material, and polishes well. It does not tend to chip out on the edges, so I find that I can spend less time on each step, or even skip a step or two, and get the same results.

I rough all my cabs on a 260 grit diamond disk and smooth out any faceted lines left from the disk on a 220 belt. I usually jump right over the 400 step and to a newer 600 diamond belt and on to a worn 1200 before polishing. If you are going to use this progression, just dry the cab off and give it a careful looking over to make sure you have removed all the scratches from the previous step. This is always a good idea, even when you aren't skipping steps—kind of a measure twice, cut once approach.

Scott Empey, owner of Gerard Scott Designs, creates hand-cut gemstones, designer jewelry, and props for the motion picture industry. His Web site is www.gerardscottdesigns.com.

# The R&G Shopper

**Welcome to the ROCK&GEM Shopper, the one-stop shopping place for your rockhounding and lapidary needs. Every month many thousands of shoppers will browse through this convenient shopping section.**
**To be part of the Shopper, call Brian Roberts at: 623-327-3525 or email: BRoberts@RocknGem.com**

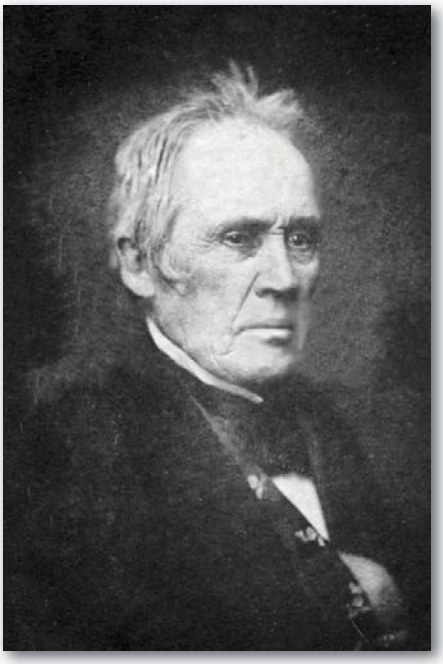
# GIANTS OF EARLY MINERALOGY

PUBLIC DOMAIN

Benjamin Silliman Jr.

PUBLIC DOMAIN

James Dwight Dana



PUBLIC DOMAIN

Benjamin Silliman Sr.

## Yale's Superstars Elevated Minerals to a Science

Story by Bob Jones

Yale University, in New Haven, Connecticut, got its charter in 1701. Founded as a theology school, it had incorporated arts and sciences into its curricula by 1777. Sheffield Scientific School was established in 1847, and the first professorship of practical chemistry was awarded in 1846.

Top chemists at Yale were responsible for great advances that established geology and mineralogy as recognized sciences in the United States. Three of these Giants of Mineralogy are particularly notable.

BOB JONES PHOTO

**Board member Gail Spann examines a *Histoire Naturelle* specimen and color plate being held by Stefan Nicolescu.**

## BENJAMIN SILLIMAN JR.

Mention Benjamin Silliman Jr. to many mineral collectors today, and they ask whether he is a collector or dealer! Yet, a century ago, the name Silliman was on the lips of every mineralogist, every chemist—in fact, every scientist. The work he did at Yale University in the 1800s made that institution the leading center for geology, mineralogy and chemistry.

Silliman Jr. was one of the first professors of science in America, and during his career he propelled Yale into a leadership role in the world of science. Through his writings and teachings, he had an amazing influence on several important fields: geology, volcanology, mineralogy, and even botany. At Yale, he established the Sheffield School of Science and started the *American Journal of Science* in 1916.

Speaking of botany, in the 1800s the mineral sciences were organized under the same system as were plants and animals, known as the Linnaean system. Scientists assigned these inorganic items a class, order, genus and species. Trying to classify minerals this way was decidedly awkward, but it continued in use until the mid-1800s.

Silliman Jr. was a leader in many ways, and he is credited with assembling an amazing mineral collection, which by 1825 was considered the largest and most important collection of minerals in the world. The Yale collection held thousands of specimens, primarily because he was able to obtain several famous collections, including the 12,000-piece collection of George Gibbs III in 1811-12. He added the Perkins collection of 2,000 English specimens when he traveled to England in 1805. The Gibbs collection proved to be the most important addition to the university's collection.

ROB LAVINSKY PHOTO

**Zincite crystals from the Franklin, New Jersey, type locality are the best. This important, old specimen once resided in the Yale Collection.**

Many of these specimens are still owned by the university and will eventually be represented in the new mineral museum that has been planned to replace the current mineral displays on campus. On a visit to Yale in April 2015, I was privileged to hold in my hand a solid mass of English hematite that Silliman acquired on his trip to England. It still has the B. Silliman label intact.

As you drive along in your petroleum-powered vehicle, you certainly owe Silliman Jr. a word of thanks. When New Haven resident Colonel Edwin Drake discovered petroleum in Titusville, Pennsylvania, Silliman Jr. and other New Haven investors financed the drilling venture and eventually formed the Pennsylvania Rock Oil Co.

"Rock oil", as petroleum was known in the 1800s, was well known around Pennsylvania in the form of small pools, seepages, and oil scum. These seepages were corralled with fencing and skimmed to produce a few gallons of the product.

Silliman Jr. had separated rock oil into its various hydrocarbon components, including kerosene, which eventually replaced candles, whale oil, and fish oil as the standard forms of illumination. He

BOB JONES PHOTO

**Connecticut Hall, Yale's oldest building, is where Yale's collection was first displayed in the 1800s.**

did this by passing heated rock oil gases through charcoal-filled retorts to capture the products. This method evolved into the very valuable fractional distillation process that is so critical to the petroleum industry today.

Silliman Jr. also suggested that drilling would supply huge quantities of this new and valuable product, kerosene, saying "it has a much higher value as an illuminator than I had dared hope" this quoted from the privately printed ("New Haven and the First Oil Well", by Henry Townsend, 1934).

Separating the kerosene component of rock oil launched the petroleum industry, out of which developed the immense fortune of John D. Rockefeller, who quickly cornered the kerosene market. Gasoline, another petroleum product that was initially thought to be useless, soon became the most important fraction of petroleum when the automobile industry emerged in the 1ate 1800s and early 1900s. Clearly, the work on petroleum by this Yale scientist had an immense impact on science, industry and society!

When I studied the Bristol copper mine, in Bristol, Connecticut, I found that three Yale professors, including Silliman Jr., were original investors. I also found out the original discoverer of the deposit was a distant relative of my three children through their mother's family, who were early settlers in Connecticut. More importantly, the Bristol mine was in large part responsible for the rise of Connecticut's brass and clock industries.

Silliman Jr. When production at Bristol was growing, superb specimens of chalcocite, bornite, and other minerals were being produced in quantity. Stockholders wanted the specimens added to the ore smelter in order to enrich the final product. Silliman Jr. fought against smelting specimens, wanting them saved for scientific study and to be preserved in the Yale collection. In protest to the smelting of specimens Silliman resigned his holdings in the mine. Ironically, the majority of Bristol specimens in the collection seen at Yale today were obtained from the mine's assayer and sold to Yale.

## JAMES DWIGHT DANA

James Dwight Dana, a student of—and later assistant to—Silliman Jr., is often thought of as the father of modern mineralogy. In 1837, he published his first book on mineralogy, *System of Mineralogy*, which evolved through the years into a seven-volume set that can be considered the bible of the science. Its early editions followed the Linnaean system.

With the publication of his *Manual of Mineralogy*, Dana introduced his own system, which classifies minerals according

PUBLIC DOMAIN

**A statue of former professor Benjamin Silliman Sr. stands in front of Yale's Sterling Chemistry Laboratory.**

BOB JONES PHOTO

**This topaz and zinnwaldite specimen is from the exceptional Gigot D'Orsy collection, bought by George Gibbs and obtained by Yale around 1812.**

to their chemical compositions, a system that is still in use today. The main classes he established are Elements, Oxides, Halides, Sulfides, Carbonates, Phosphates and Silicates. This work has been refined as scientists have gained a greater understanding of minerals. The eighth edition, titled *Dana's New Mineralogy*, is still in print. Dana followed in the footsteps of Silliman Sr. and Silliman Jr. as a professor at Yale, and is well known among today's collectors for these works.

Far more than a leading mineralogist, Dana was a trained geologist, volcanologist and zoologist. As a sophomore at Yale, he traveled the South Seas and became an expert on corals and volcanoes.

Dana was a regular contributor to the *American Journal of Science*. He eventually became co-editor of that publication with Silliman Jr. He also became the president of the American Association for the Advancement of Science and the Geological Society of America. Dana became an important contributor in the field of geology as he gradually organized the huge quantity of geologic knowledge of his time.

His contributions to the science of geology included predictions about the movement of continents that proved accurate many years later. He also predicted the existence of gold in California.

## BENJAMIN SILLIMAN SR.

Benjamin Silliman's father, Benjamin Silliman Sr., predated his son as a Yale professor, and is credited with establishing that what were then called "sky stones" were actually meteorites. When a sighted and verified fall took place in nearby Weston, Connecticut, in 1807, Silliman Sr. was able to gather eyewitness accounts and analyze the stone whose landing was witnessed and proved it was like others that had been found after they fell. Thus, he became the first American scientist to scientifically describe a meteorite.

By the time Silliman Sr. died in 1853, he had made Yale the most important institution in science education. In 1818, he started publishing the *American Journal of Science*, which was an instant success. As

*continued on page 68*

ROB LAVINSKY PHOTO

**The rare species gibbsite was named after Colonel George Gibbs III, whose mineral collection was acquired by Yale University early in the 19th century.**

ROB LAVINSKY PHOTO

**This specimen of the mineral sillimanite, named after Professor Silliman Sr., was once in the collection of Charles Shepherd, Silliman's assistant in 1827.**

ROB LAVINSKY PHOTO

**The importance of this wellsite specimen is that it was owned by the great 1800s collector G.J. Brush, who gave his collection to Yale.**

DO IT YOURSELF

# Clean Cutter

## Give an Old Rock Saw a Facelift

Story and Photos by Jim Cerenzie

A few months ago, I purchased sight unseen an old Jenkins Royal 14-inch rock saw from my rock club, the Cascade Mineralogical Society. Upon initial inspection, it was apparent that this thing hadn't been used in quite awhile. The insides were a rusty, nasty, thick coat of hardened, smelly old oil.

This, however, didn't intimidate me. I like restoring old things to like new. I have a second AAS degree in Automotive Collision Repair from South Seattle Community College, so I could see myself using these background skills in restoring this old machine.

I used a metal scraper to remove the caked-on and hardened grease from the tank.

POR 15 degreaser, wire brushes, and red Scotch Brite pads work to thoroughly clean all the grease off the parts.

First, I removed the lid, sight window, hinges, electric motors, wiring, pulleys, belts, and associated hardware. The next day, I removed all the internals: carriage, clamp, arbor, saw collars, and associated hardware. I took lots of pictures with a digital camera for future use in putting everything back together.

As a side note, I could feel every roller turn in the arbor bearings, indicating that they were corroded from being idle for so long. However, since there was absolutely no radial or axial play, and on the advice of two other people, I decided not to dismantle the arbor. I myself am a big fan of the maxim "If it isn't broke, don't fix it". So hopefully, with some use, the bearings will wear smooth again.

The next step was to start cleaning the lid and tank. First, I used a metal scraper to get the thick coating of rusted gunk off the metal surfaces. I suggest doing this in the sun because it seemed to help soften the hardened, crusty mess. I got as much off as I could to make the next step in the cleaning process easier.

Next, I used a large wire brush, small wire brush, and POR 15® degreaser from the local auto body supply store. I liberally sprayed the POR 15 on one panel at a time, then scrubbed all the remaining grease and oil off the metal surface. I used the small wire brush to get into the corners. If the POR 15 started to dry out while I was scrubbing, I sprayed it again to keep the surface wet.

After cleaning the areas with thick grease, I used a red Scotch Brite® pad to scrub the area until I knew for certain it was clean. Then I moved to the next panel and repeated the process. When finished, the areas that were scrubbed were dry. All I had to do is turn on the garden hose and rinse it all off.

I want to stress how critical it is to remove every trace of oil and grease from the metal in order to get good adhesion and to prevent "fish eyes" in the top coats of primer and paint, to be applied later.

Next, I used Transtar® U-POL wax and grease remover, which I purchased at the auto body supply store, to wipe down the outer surface of the tank where the old green paint had been applied. This ensures that no contamination impregnates the metal when I mechanically strip the old paint off with a polycarbide wheel on an angle grinder.

(I like to use Transtar products because they are just as reliable as the major brands, but I'm not paying Jeff Gordon or Penske Racing's sponsorship. A cheaper alternative would have been to use denatured alcohol, but I didn't have any.)

Polycarbide wheels work great, making the removal of old paint quick and not messy, and is nontoxic, unlike paint stripper. I also used a polycarbide wheel on a drill motor to remove the scale rust inside the lid and tank. These wheels are cheapest at Harbor Freight.

The next step was to mix four parts water to one part white vinegar from the grocery store. I poured this mixture into an empty spray bottle, liberally sprayed it onto all the bare metal surfaces, and scrubbed vigorously with a red Scotch Brite pad.

This serves three purposes: to clean, to kill any rust hiding in the pores of the metal, and to etch the metal for good adhesion

Rinsing the degreaser off the tank with water leaves bare, clean metal.


I used polycarbide wheels on an angle grinder and POR 15 cleaner/degreaser to strip off the old paint and rust.

Scrubbing the metal with red Scotch Brite pads and the 4:1 water/vinegar mixture kills any hiding residual rust and cleans and etches the bare metal surface.

Letting the vinegar/water mixture dry at least 15 minutes leaves an ugly, rusty-looking mess.


I mixed the epoxy primer/sealer components and sprayed it directly onto the prepped, bare metal surfaces.

I applied the second and final coat of epoxy primer/sealer using a spray gun hooked up to an air compressor.


I shot three layers of clearcoat over the colored paint.

Apply white masking paper and green masking tape to the galvanized lid to keep overspray off the top.

**The fully cured paint looks pretty good for having sat on the shelf for 11 years!**

**I mounted the motor under the utility cart so the saw would be lighter to.**

of the epoxy primer. There are other, more expensive ways to do this, but the vinegar/water mixture is effective and nontoxic—certainly good enough for a rock saw.

I let the vinegar/water mixture dry at least 15 minutes and ended up with an ugly, rusty-looking mess. (This isn't rust, so don't panic.) Using a garden hose or a bucket of clean water, I rinsed it off while scrubbing the orange-looking stuff off with a Scotch Brite pad.

When all traces of the rusty-looking stuff was gone, I wiped it all dry with a clean shop towel and let it dry thoroughly overnight.

The next morning, I wiped down the inside of the lid and the entire tank with U-POL wax and grease remover (denatured alcohol would also work). Again, the cleanliness of the metal is of utmost importance. I then masked off the top of the lid with white masking paper and green masking tape. Newspaper or hardware store masking paper won't work; it will disintegrate when the urethane-based paint I use comes into contact with it.

Next, I mixed Transtar 2K epoxy primer/sealer that was also purchased at the auto body store. I loaded it into my spray gun and shot two coats on. I used epoxy because it has a high resistance to rock chips, oil and grease. Auto restorers use it to paint frames and suspension parts for that reason.

After the epoxy primer/sealer had cured overnight, I scuffed it with a red Scotch Brite pad and then wiped it down again with the wax and grease remover.

I had dug out some leftover DuPont "Island Teal" paint and Transtar clearcoat that had been sitting on my shelf for 11 years—*way* past its shelf life. (I had used it to paint a '68 Camaro I restored.) But it was only a rock saw, so I thought I'd use the old paint instead of throwing it away and buying new. I mixed the color and shot three coats inside and outside the tank and under the lid. After cleaning the spray gun, I shot three layers of clearcoat over the color.

I let the paint cure nice and hard for a week before putting the saw all back together.

Re-assembly began with cleaning all the nuts, bolts and hardware. I also bought some neoprene washers from the plumbing section of the hardware store. I wanted to create a good seal where the bolts penetrate the tank for mounting the internal and external components, and I had read somewhere that a guy who restores lapidary equipment uses neoprene.

I also purchased some new electrical cord to replace the old, cracked and worn-out cord that goes from a switch to a power outlet on the back of the saw and from the switch to the wall outlet.

I got some auto body seam sealer for sealing around the sight window on the lid. It holds up well against mineral oil. I also bought some new drive belts for the saw blade and carriage clamp feeder.

**The very first rock I cut with the restored saw was Glass Buttes Rainbow obsidian.**

Next, I installed the carriage, arbor and drive pulleys, basically in the reverse order of disassembly. This is where all the digital pictures I took of the disassembly came in handy.

I mounted the saw blade on the arbor to see how it looked and hand spun the blade pulley to find out that the blade wobbled from side to side. When I took the blade back off and laid it on a flat stone, I found that it was dished, or warped. After consulting with fellow club member Rich Russell, who owns several saws, I ordered a new 14-inch MK-303 blade. Ouch.

Rich also told me that the electric motor should be around 1750 RPM. The motor that came with the saw was a Sears Craftsman 3450 RPM motor. My guess was that the too-powerful motor had spun the blade too fast, which overheated and warped it.

Luckily, I had an old AC motor that spins at 1750 RPM, that is period correct for this saw. I devised a plan to mount it under a utility cart I purchased at the hardware store. The reason I mounted it under the saw on the utility cart is to make the saw lighter for lifting and draining the oil.

Lastly, I installed the saw lid and filled the tank with mineral oil. I loaded a piece of Glass Buttes Rainbow Obsidian and turned it on. The slab came out beautifully with a nice straight and smooth cut!

These steps should be helpful to anyone who wants to restore, or simply clean, their rock saw. For a good article about rock saws, visit http://home.comcast.net/~eugenemineralclub/rocksaws.pdf. To see a polycarbide wheel in action, go to www.youtube.com/watch?v=d6XnIg1yECQ.

# Worldwide Rock Shops

GETTY IMAGES

## Use the Internet to Plan Rock Stops on Your Next Trip

Story by Jim Brace-Thompson /
Photos Courtesy Charlie's Rock Shop

When it comes to high tech, I'm of that "in between" generation. When I was growing up, we still wrote and mailed letters with ink and paper, licking a stamp and patiently waiting two weeks or longer for a reply. In fact, that's how I courted my wife, using tissue-thin paper since she was in England, which put overseas postage—determined by weight—at a premium.

Back then, when planning a trip, we went to the American Automobile Association to get TripTik Travel Planners and big, awkward paper maps. (Was it just me, or was it truly impossible to get those maps to re-fold in the same way they originally folded?) There was no GPS, MapQuest, MapBlast, or similar electronic aid.


**Charlie's Rock Shop welcomes visitors—in-person or via the Internet.**


**Charlie and his assistant, Camille, stand before an ammonite fossil collected on the English coast.**

It wasn't until nearly a decade into my career that this thing called the Internet took hold. So vital has it become, however, that it's hard to imagine how we ever lived without it—although my mother seems to have succeeded. The Internet can be your best friend—and should be your go-to resource—the next time you plan a trip, near or far, that might in any way involve rockhounding, rock shops, and adding to your collection.

Thanks to a business trip that helped subsidize our expenses, my wife, Nancy, and I found ourselves flying from California eastward over the North American continent and across the Atlantic Ocean to that island nation called the United Kingdom in mid-October 2014. Ten hours, 30 minutes on a plane, 5,470 miles, and an eight-hour time zone change is a long way to go to visit a rock shop! But after spending four days in boardrooms and business meetings, there we stood on my one free day at Charlie's Rock Shop, at the next-to-last stop on the southern leg of the London Underground, one stop away from Wimbledon.

Our daughter, Hannah, a former pebble pup of our Ventura, California, gem and mineral society, and her boyfriend, Peter, were there. Having recently moved from Berlin, Germany, to Edinburgh, Scotland, they had taken the train down to join us. When we said we'd be going to a rock shop in addition to Big Ben, the Tower of London, and Harrods, Hannah just rolled her eyes. Anything to humor the old man and his obsession.

On my way to London, I had picked up the November 2014 issue of *Discover* from the magazine kiosk at Los Angeles International Airport, and during the flight I read an article about the "Jurassic Coast", the Dorset and East Devon region of southern England where Mesozoic Era fossils have long been collected. These include such sleek and bizarre marine reptiles as ichthyosaurs, pliosaurs and pleisiosaurs, as well as those more prosaic mollusks, the ammonites.

The article reported that the coast, although a World Heritage Site, is still open to responsible collecting by amateurs thanks to laws that are far more common sense-based and collector-friendly than the increasingly stringent laws being enacted in the United States. Here, we see collecting sites diminish year by year as lands get incorporated into military bases, National Parks, or National Monuments by executive order, or as private property gets closed off thanks to over-the-top liability concerns in an increasingly litigious society.

Unfortunately, given our schedule, there was no way we would be getting to the southern coast for hands-on collecting. Fortunately, Charlie had a fancy for fossils, and Nancy and Hannah managed to track down his shop on the Internet while Peter pulled up directions using his cell phone. (As for me, well, I provided the moral support and encouragement while everyone else used their electronics.) Charlie's shop was celebrating its 25th anniversary, and not only did we enjoy chatting with Charlie and his assistant, Camille, we walked away with three ammonites from the Dorset coast, as well as a fossil fish from the Devonian "Old Red Sandstone" of my daughter's new Scottish homeland.

Charlie's Rock Shop, which is described on its Web site as "a real Aladdin's cave, stocking something for everyone", wasn't all that different from a rock shop in the United States. For instance, we saw a lot of Moroccan fossils, including cephalopods, trilobites, and shark teeth, beads and jewelry, healing stones, and common gemstones and minerals. But the local U.K. rocks and minerals like Weardale fluorite and Cumberland hematite, as well as those Dorset fossils, made all the difference, and the setting was a bit different, too.

Charlie's Rock Shop is located in The 1929 Shop, which was the last of eight buildings constructed in what is now called Merton Abbey Mills on the River Wandle. The 1929 Shop was restored in 1989, when Charlie's moved in.

The complex, which is now a craft village, consists mostly of buildings constructed in the late 1800s and early 1900s as part of the Liberty silk-printing and textile works, but it includes the Colour House Theatre, which is believed to have

been part of a medieval monastery (Merton Priory) demolished by Henry VIII in 1538. You don't encounter that sort of history every day in the States, especially around my home on the West Coast, where something is considered historic if it was built before 1970.

Most of the buildings now house shops like Charlie's, studio offices, restaurants, and a riverside pub. An open-air crafts market and food bazaar was going on the day we visited, and occurs every weekend. Summer months feature social events and live music as part of Abbey Fest.

The enclave bills itself as "London's alternative market" and is considered one of south London's major regeneration successes after the grounds had been left derelict for nearly two decades prior to 1989. Internet reviews characterize it as "one of the gems of southwest London," "a great place to hang out with family and friends", and "a quiet oasis of calm and friendliness" in the midst of one of the world's busiest cities. It's a pleasant and easy 10-minute walk from the Colliers Wood tube station. As a bonus for the traveler: Charlie's Rock Shop is open each and every day of the week.

## SEARCH TIPS

So how did we discover Charlie's? As indicated above, we searched the Internet, finding not only the Charlie's Rock Shop Web site, but also sites describing Merton Abbey Mills and offering comments and reviews that indicated this should be a "must visit" while we were in London. Whenever you find yourself traveling on business or pleasure, I recommend you Google "rock shop" to see what treasures might be in the area, like Charlie's.

You can visit Charlie's without the hassle of LAX or Heathrow airport security and babies crying for hours two cramped seats behind you. Just go to www.charliesrockshop.com. A piece of advice: Be persistent and creative in your Web searching. Simply searching "rock shop" will lead to all sorts of not-so-relevant hits for folks seeking minerals or fossils, such as music stores and Hard Rock Café sites. Narrow your search geographically and exclude such key words as "music" or "café".

With the Internet, no matter where you are, a little persistence and creative searching mean rock shops are just a click away. In fact, while planning our trip to Scotland for our daughter's wedding over the summer, I started surfing the Web for rock shops in and around Edinburgh. Not only did I find a great-looking fossil shop just blocks from my daughter's address, but I landed some contacts with members of the Scottish Mineral and Lapidary Club, who have welcomed a visit and have already provided suggestions for collecting sites for Scottish agates.

Googling is also how we discovered a half dozen rock shops in and around Ann Arbor while visiting my son in his new home in Michigan last summer. It led to a visit to see the Michigan state fossil at a museum on the University of Michigan campus and the opportunity to purchase specimens of the Michigan state rock and mineral at local shops. Whether traveling far and wide, or just the next state over, if it's rocks and rockhounds you're seeking, make the Internet your first stop before hitting the road!


**While at Charlie's Rock Shop, we "collected" some fossils from the "Jurassic Coast" of Dorset and East Devon, including ammonites.**


**Omitting "music" and "café" from our key words eliminated innumerable hits for record stores and Hard Rock Cafés!**

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# PICKS & PANS

## NEWS and REVIEWS

**87-Ounce Gold Nugget Detected**

In March 2015, metal-detector manufacturer Minelab (www.minelab.com) announced that Australian gold prospector Michael Brown had uncovered an 87-ounce solid gold nugget during a prospecting expedition in Inglewood, a town located in the state of Victoria, Australia. The Minelab detector Brown was using located the nugget under 6 inches of ground. Brown's find is estimated to be worth over $130,000 AUD, based on Australia's current gold price per ounce.

"I'm still in absolute shock about finding a gold nugget of this magnitude! As a professional gold prospector, this find is a monumental accomplishment in my career," said Brown. "I've been using Minelab detectors for years and the investment has more than paid off."

Minelab is based in Torrensville, South Australia.



**Wine & Dinosaurs Sept. 20, 2015**

From noon to 4 p.m., the Delaware Museum of Natural History in Wilmington will host its 9th Annual Wine & Dinosaurs, a Wine, Beer and Food Tasting Festival. It is the signature fund-raising event benefiting the museum (www.delmnh.org/wine-dinosaurs/).


Participants enjoy an afternoon of premium wine and specialty beers, delicious hors d'oeuvres, live music, wine and beer talks by local experts, and a silent auction. Advance tickets are $45 for DMNH members and $55 for the general public. Admission will be $65 at the door.

Participants must be 21 or older. Pre-register at www.signup82north.com/beventLive.aspx.



**Natural History Museum … To Go**

Launched in September 2014, The Natural History Museum is a mobile museum that offers exhibitions, expeditions, educational workshops, and public programming. Its programs appear within existing institutions, in its 15-passenger mobile museum bus, and online at http://thenaturalhistorymuseum.org.

The mission of The Natural History Museum is to affirm the truth of science. It also makes a point to highlight the socio-political forces that shape nature and affect the atmospheric climate on Earth. In March, it released an open letter from dozens of top scientists urging 334 museums of science and natural history to cut all ties to the fossil fuel industry.


The Museum inquires into what we see, how we see, and what remains excluded from our seeing. It invites visitors to take the perspective of museum anthropologists attuned to the social and political forces inseparable from the natural world.

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# POETRY PAGES

## Rock Bound Rockhound

### All Shook Up

An old prospector friend and I
Will in his helicopter fly
To a new adventure today,
Where plate tectonics has its way.
    It is an old  subduction zone,
    Where we'll be digging all alone
    Into an exposed pegmatite
    To search for what is shiny bright.
It's gemstones that we have in mind.
We both know that's what we will find.
It's in a mountainous terrain,
And we have checked, it will not rain.
    I climbed aboard with all my gear.
    We have not done this since last year.
    We took off heading toward the sun.
    I like rock hounding it is fun.
We used global positioning
From satellite for our bearing.
The mountains soon came into view,
Where we would land I had no clue.
    Then I saw a small level spot
    Between mountains, not near the top.
    It was the bank of a river,
    Which from the air seemed a sliver.
The level spot had some debris
Of small rocks dynamited free.
Or hammered loose from up above
By someone full of gemstone love.
    We landed and then had to climb
    The mountain side for a short time,
    Until we reached a cave-like crack.
    I never thought of turning back.
We entered and went right to work,
And followed the crack to its fork.
It was dynamited before,
There was no need for any more.

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    This crack could hold far more than two,
    And both of us knew what to do.
    There was mica, quartz and feldspar,
    We knew gemstones could not be far.
My eye then spied a red garnet
Of golf ball size that I should get.
My rock hammer freed it from rock;
I wrapped it safe in an old sock.
    Garnet's color is, it's been said,
    Mysterious deep purple-red.
    Not bright red like a firehouse,
    Yet full of fire you can't douse.
We worked until we got our share,
And there was even more to spare.
What prompted us to leave right then
Is something that's beyond my ken.
    We both descended how we came
    To load the helicopter's frame.
    What happened next I can't be sure.
    It happened with our gear secure.
The mountain shook and rocks did fall.
I could not stand, but had to crawl.
My friend said, "Stand! Control your fear,
Before that landslide settles here!"
    I pulled myself in through the door.
    I felt vibrations through the floor.
    Everything seemed to be moving,
    When rocks fall don't think of staying.
The shaking seemed to last minutes.
Pebbles hit us like small peanuts.
They deflected off the rotor
To add to the noisy motor.
    As his craft lifted and it banked,
    We both silently prayed and thanked
    Our God who helped us fly from there,
    And helped lift us high in the air.
The motor surged; we flew away
To return there another day.
If we did not leave when we did,
We'd be buried, our bodies hid.
    We had survived an earthquake's shock
    That shook us both and tumbled rock.
    Quickly you hide or get away
    To live and have something to say.
What I would tell is how it feels
To see beauty; how it appeals,
And what it means to gather gems,
The kind that's put in diadems.

*—Ronald J. Yadusky, BS, MD, FACS*

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## Triple, Trio, and Three

It Does Exist

Silicon dioxide is quartz.
It's also rock crystal of course.
It can be found in mountain chains
That rise up higher than the plains.
  Get used to having triple names.
  It's not semantic word-filled games.
  The mountains are orogenies,
  Tectonic uplifts, if you please,
But that's what they're called technically.
They're also named specifically,
Like Himalayas or Rockies.
But Baja's Sur Tres Virgenes
  Was formed from forces tectonic
  That made three mountains volcanic.
  Some mountains can be windblown piles
  That have high peaks that range for miles.
What's solid, liquid, and gas make
The land and sea and air we take
To be electrons and protons,
And a third item called neutrons.
  Space, time, and matter all persist
  In being triple to insist
  That there be found in every day
  Alpha, beta, gamma decay.
The Periodic Table came
Out of a Law that had this name:
The Law of Triads, then in print.
This Law gave the Table's blueprint:
  The second element of three
  Did average, you will agree,
  Between what was the first and third
  With each one named with its own word.
Wave's amplitude, wavelength, and phase
May act in ribbon, tube, string ways
Connecting with loop, braid or twist.
To focus three, which does exist.

*—Ronald J. Yadusky, BS, MD, FACS*

## The Package

One bright, frosty morning, all cozy in bed,
I hit the snooze button, and covered my head.
At 7:00 am came a knock on the door,
Then ringing the doorbell, and knocking some more.

  I awoke with a startle, and reached for my jeans,
  Made my way down the stairs, and looked out at the scene.
  But what to my wondering eyes did appear?
  My post woman, gleaming, a heart full of cheer!

"I'm sorry to wake you," she said with a smile,
"But it's really quite heavy, and has come many miles!"
The postmark "Australia," my heart leapt with glee!
I had waited for months for this package by Sea.

I grabbed up her pen and said, "Where do I sign?"
Her breath, white with frost, "This line will be fine…"
"Careful," she said, "'cause it's heavy as rocks!"
I laughed to myself as she gave me the box.

  If she only knew what we shipped to each other,
  She'd throw up her hands, and not bring me another.
  She climbed in her truck, full of boxes and bills.
  With a wave and a grin, I closed out the chill.

The box was all broken, and the side was agape,
Held together with hope, and a whole lot of tape.
Box within box, stuffed and packaged with care,
Leanne took great pride to make sure it got there.

My scissors in hand, and a hot cuppa Joe,
I cut through the tape like gift with a bow.
At first, it peeked out, then it started to flirt,
Then it winked from the box, even covered with dirt.

  With anticipation, I pulled out a hunk.
  Then piece by piece, I examined each chunk.
  I carefully placed each one in a pan,
  And ran to the sink, to rinse off the sand.

Then up from the sparkling bowl did appear,
The loveliest Boulder I've ever been near.
The color, it dances and flashes with fire,
The seams and the patterns I truly admire.

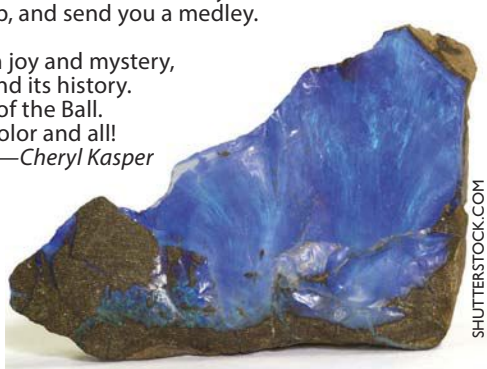
'Tis Opal, they say, can drive a man mad,
And crazy with wanting more opal so bad.
Not matter what type, he keeps wanting more
Of those packages arriving at his front door.

  But I will try to exercise prudence,
  And share my purchase with all of my students.
  And as I wait for the new year to start,
  Biting my nails, while we are apart.

I promise I'll try to save you some Boulder,
Even if it makes me 50 years older.
But if you can't wait, email Leanne Smedley.
She'll set you right up, and send you a medley.

Now embrace this season with joy and mystery,
Enjoying the beautiful earth and its history.
Here's to the Opal, the Queen of the Ball.
Now flash away! Flash away! Color and all!

*—Cheryl Kasper*



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*Cheryl Kasper is an Opal Instructor, at the William Holland School of Lapidary Arts, in Young Harris, Georgia.*

BOB JONES PHOTO

Editor Bob Jones holds the Benjamin Silliman hematite specimen with the original label still intact.

BOB JONES PHOTO

Advisory Board member Gene Mieiran holds the English hematite Silliman brought back from England.

professor of the sciences, Silliman Sr. taught a number of students who made important contributions to the sciences. In mineralogy the single most important students he taught were his son, Silliman Jr., and Dana. Keeping things in the family, Dana eventually married Silliman's daughter Henrietta and their son, Edward Salisbury Dana, was born in 1849. He also contributed to the Yale science legacy.

## BUILDING THE COLLECTION

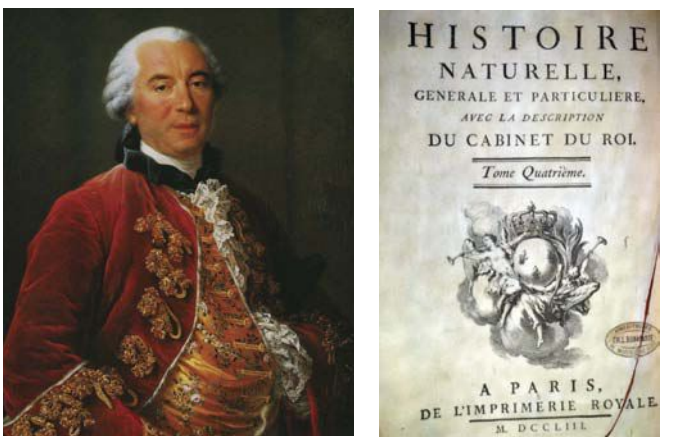
The Yale mineral collection holds thousands of specimens from collections assembled in the 1800s. The most noteworthy is the Gibbs collection. Gibbs had a knack for adding specimens to his collection during his travels. While in Europe, Gibbs met Russian Count Gregori Razumovski, who was traveling with his superb collection of Russian minerals. This was a common practice those days. The Count was heading back to Russia, but did not wish to take his minerals, so Gibbs bought the 6,000-specimen collection, combining it with his own.

Shortly after this Gibbs, the son of a wealthy Rhode Island merchant, found out the 4,000-specimen collection of Frenchman Jean Gigot d'Orsy was for sale. Gibbs bought that collection, then headed back to Newport, where his acquisitions were put in storage before he returned to Europe.

Silliman Jr. was able to see part of the stored Gibbs collection in Newport. When he had a chance, he convinced Gibbs to loan some of his collection to Yale for display, and in 1812 the Yale collection, now totaling 10,000 specimens, was put on exhibit. Gibbs eventually sold his entire 20,000-specimen collection to Yale.

In those days, there was no Peabody Museum of Natural History on campus. The Yale collection was housed in Connecticut Hall, overlooking the Commons. Connecticut Hall is the oldest building on the Yale campus and still in use! From there, the collection was transferred to the new Peabody Museum, where I saw the collection as a 10-year-old in 1936. I think it is interesting that the new Yale Mineral Museum we are currently working on will be in the exact same room in which I saw the collection in 1936. Fortunately, the Gibbs, Razumovski, d'Orsy and Silliman minerals are still in the Yale collection, and much of it will be on display in the new museum.

There's one small problem, though: The staff is finding that




PUBLIC DOMAIN

The Count de Buffon (1707-88) developed a process for printing color images of minerals in his ***Histoire Naturelle***.

many of the early acquisitions cannot be matched to the old collections from which they came. Only those that have been identified will be exhibited.

One or two of the specimens are figured in an old French book. *Histoire Naturelle*, by Count de Buffon, is a remarkable text that was started in 1741. It compiles all the knowledge that was then available on minerals, birds, and the quadruped animals. Remarkably, Buffon had developed a process for printing color images of minerals. These were probably the first-ever color mineral prints, preceding the better-known Sowerby and Rashleigh texts with their color renditions of minerals.

The opening date for the new Yale University Mineral and Gem Museum has yet to be announced as of this writing, but the plan is to open it in 2016. You can bet I'll be there, celebrating my many visits over the past 80 years to one of the great, historically important mineral museums in America. I expect every *Rock & Gem* reader will make a pilgrimage sometime to visit this amazing museum, which is really the foundation of modern mineralogy. You'll see marvelous, historically important specimens and learn the history of Yale's Giants of Mineralogy, who contributed so much to the development of the science in America. See you there!

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## Show Dates *from page 41*

door prizes. ; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: http://www.gemfaire.com

**18-20—RICHMOND, VIRGINIA:** Retail show; Treasures of the Earth, Inc., Richmond Raceway Complex; 600 E Laburnum Ave.; Fri. 12 noon-6 pm, Sat. 10 am-5 pm, Sun. 10 am-4 pm; Adults $5.00, military Free with ID, Children 16 and under Free; Vendors from across the US bring their merchandise to you. You will find • 14K and sterling silver, classic, estate, fashion and handmade jewelry • Loose stones, beads and findings, pearls • Mineral specimens, crystals, lapidary supplies • Books, carvings and gift items Displays and demonstrations by the Richmond Gem & Mineral Society ; contact Jane Westbrook, PO Box 59, Gloucester Point, VA 23062, (804) 285-4281; e-mail: jane@treasuresoftheearth.com; Web site: www.treasuresoftheearth.com

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**19-20—CHICO, CALIFORNIA:** Annual show; Feather River Lapidary & Mineral Society Inc, Sliver Dollar Fair Grounds; 2357 Fair st.; Sat. 9:30 am-5 pm, Sun. 9:30 am-5 pm; Students, Adults + Seniors $3, Children under 16 Free!; Annual Show: Feather River Lapidary & Mineral Society: Chico's Silver Dollar Fair Grounds: 2357 Fair St: Sat. + Sun. 9:30-5: Adults $3 children (16 & under) free: HOME OF THE WORLDWIDE ROCK TUMBLING COMPETITION! Free shark tooth necklace, first 200 Kids. Dealers Opals, Rough Rock, Crystals, Fossils, Jewelry, Minerals, Wire Wrapping, Flint, Knapping, jewelry making, silent auction, door prizes, raffle, Boy & Girl Scout Badge area, Kids wheel of fortune, grab bags FUN FOR THE WHOLE FAMILY! Contact John Scott 1288 Glenwood ave. Chico ,CA 95926. (530-343-3491): e-mail jweazel@sbcglobal.net Web site: www.featherriverrocks.org ; contact John Scott, 1288 Glenwood ave., Chico, CA 95926, (530) 343-3491; e-mail: jweazel@sbcglobal.net ; Web site: www.featherriverrocks.org

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*continued on page 74*

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## Show Dates *from page 70*

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**25-27—JOPLIN, MISSOURI:** Annual show; Tri-State Gem & Mineral Society, Joplin Historical & Mineral Museums Inc.; 504 Schifferdecker Ave.; Fri. 9:00 am-5:00 pm, Sat. 9:00 am-5:00 pm, Sun. 9:00 am-3:00 pm; Admission is Free!; 17th Annual ROCK-A-THON, gem and mineral expo. Held inside the Joplin Mineral Museum. Free Admission. Door Prizes. For more information EMAIL jmc-cwiseman@sbcglobal.net; contact Christopher Wiseman, (417) 623-1180; e-mail: jmc-cwiseman@sbcglobal.net

**26-27—SANTA ROSA, CALIFORNIA:** Annual show; Santa Rosa Mineral & Gem Society, Wells Fargo Center; 50 Mark West Springs Road; Sat. 10:00 am-6:00 pm; Adults $6, Children under 12 Free; Lots of Vendors, Bake Sale, Raffle, Rough Rock Sale, Wire Classes, Fun Kid Stuff; contact Jolene Coon, (707) 849-9551; e-mail: jolene4srmgs@gmail.com; Web site: SRMGS.ORG

**26-27—FRANKLIN, NEW JERSEY:** Annual show; Franklin Mineral Museum, Franklin Elementary School; 50 Washington Ave; Sat. 9 am-5 pm, Sun. 10 am-4 pm; Adults $7, Children $4; Saturday, September 26th and Sunday, September 27th Indoor show: Saturday 9:00 am to 5:00 pm. Sunday 10:00

*continued on page 76*

The Original

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*Photos by Jeff Scovil©*

www.DenverMineralShow.com

## Show Dates *from page 74*

am to 4:00 pm. Outdoor Swap: Saturday 7:30 am to 6:00 pm. Sunday 10:00 am to 5:00 pm. Adults:$7 and Children are $4 (ages 6-16); contact Robyn Seger, 32 Evans Street, Franklin, NJ 07416, (973) 827-3481; e-mail: pesolutions.minerals@gmail.com; Web site: http://spmom3.wix.com/franklin-gem-mineral

**26-27—DOWNEY, CALIFORNIA:** Annual show; Delvers Gem & Mineral Society, Elks Lodge; 11233 Woodruff Ave.; Sat. 9 am-5 pm, Sun. 9 am-4 pm; Admission is Free!; 20+ vendors, displays, raffle, demonstrations, and wonderful grab bags.; contact Dale Harwood, 1914 El Segundo Apt. 2, Gardena, CA 90249-1871, (310) 217-0551; e-mail: nancyjbird@verizon.net; Web site: https://groups.yahoo.com/neo/groups/delvers/info

**26-27—FRANKLIN, NEW JERSEY:** Annual show; Franklin Mineral Museum, Franklin School; 50 Washington Ave; Sat. 9 am-5 pm, Sun. 10 am-4 pm; Adults $7, Children Ages (6-16) $4 ; contact Pat Seger; e-mail: pesolutions.minerals@gmail.com; Web site: https://www.facebook.com/pages/Annual-Franklin-Mineral-Museum-Gem-Mineral-Show

**26-27—MONTEREY, CALIFORNIA:** Annual show; Carmel Valley Gem & Mineral Society, Monterey Fairgrounds; 2004 Fairgrounds Road; Sat. 10 am-6 pm, Sun. 10 am-5 pm; Adults $4.00, Children under 12 are FREE!; We have approx 15 dealers at the show featuring jewelry, cut and uncut gemstones, beads, crystals, rough and polished rocks, mineral specimens, and fossils. This annual event also has over 50 displays featuring the gem, mineral, and fossil collections of guest and member exhibitors. In addition, there will also be demonstrations of jewelry making, sphere making, rock grinding and polishing. A silent auction will run continuously for people to bid on. This is a family event with plenty of great activities for the kids. A full snack bar is always open with drinks, hot dogs, chili, homemade sandwiches, and desserts. This event supports the Carmel Valley Gem & Mineral Society's educational outreach for Monterey schools. ; contact Janis Rovetti, 1047 Roosevelt Street, Monterey, CA 93940, (831) 372-1311; e-mail: janis12@sbcglobal.net; Web site: www.cvgms.com

## October 2015

**2-4—DEL MAR, CALIFORNIA:** Wholesale and retail show; Gem Faire Inc, Del Mar Fairgrounds; 2260 Jimmy Durante Blvd; Fri. Noon-6 pm, Sat. 10 am-6 pm, Sun. 10 am-5 pm; Students, Adults + Seniors $7, Children ages 0-11 are free!; Fine jewelry, precious & semi-precious gemstones, millions of beads, crystals, gold & silver, minerals & much more at manufacturer's prices. Exhibitors from around the world. Jewelry repair & cleaning while you shop. Free hourly

*continued on page 79*

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## Show Dates *from page 76*

door prizes. ; contact Yooy Nelson, (503) 252-8300; e-mail: info@gemfaire.com; Web site: http://www.gemfaire.com

**2-4—INDIANAPOLIS, INDIANA:** Annual show; Treasures Of The Earth Gem & Jewelry Shows, Indiana State Fairgrounds, Agriculture/Horticulture Bldg.; 1202 E. 38th St.; Fri. 10-6, Sat. 10-6, Sun. 11-5; adults $5 (3-day pass), children (under 16) free; beads, pearls, gemstones, gem trees, wire wrapping, wire sculpture, silversmiths and goldsmiths, custom work and repairs while you wait, door prizes, classes available, Western jewelry; contact Van Wimmer, Show Director, 5273 Bradshaw Rd., Salem, VA 24153, (540) 384-6047; e-mail: van@toteshows.com; Web site: www.toteshows.com

**2-4—ALBUQUERQUE, NEW MEXICO:** Annual show; Jay Penn, Expo NM ; 300 San Pedro NE, 87108; Fri. 9:00 am-5:00 pm, Sat. 9:00 am-5:00 pm, Sun. 9:00 am-5:00 pm; Admission is Free!; Gem & Mineral show in the Creative Arts Bldg. @ NM State Fairground (Expo NM). Enter Gate 3 @ San Pedro & Copper (west side of the fairgrounds). FREE ADMISSION. 60+ dealers, gemstones, mineral specimens, rough, slabs, jewelry, beads, cabochons, fossils, tools. Contact Jay Penn, 505-883-4195, jaypenn246@gmail.com. Website: abqfallshow.wix.com/abq-fall-show; contact Jay Penn, 2324 Alvarado NE, Albuquerque, NM 87110, (505) 883-4195; e-mail: jaypenn246@gmail.com; Web site: abqfallshow.wix.com/abq-fall-show

**2-4—CLARKDALE, ARIZONA:** Annual show; Mingus Gem & Mineral Club, Elks Club Lodge, Clarkdale, Arizona; 100 S. Broadway; Fri. 9:00 am-5:00 pm, Sat. 9:00 am-5:00 pm, Sun. 10:00 am-4:00 pm; Adults $2, Children are Free with Adult; contact Amy Joe, (505) 204-6881; Web site: www.mingusclub.org

**3-4—VISTA, CALIFORNIA:** Annual show; Vista Gem & Mineral Society, Antique Gas &Steam Engine Museum ; 2040 N Santa Fe Ave; Sat. 10 am-5 pm, Sun. 10 am-4 pm; Admission is Free!; contact Ray Pearce, (760) 535-5524; e-mail: vistarocksgms@gmail.com; Web site: Vistarocks.com

**3-4—SPRINGFIELD, ILLINOIS:** Annual show; Lincoln Orbit Earth Science Society, Illinois Building; IL State Fairgrounds, 801 Sangamon Ave; Sat. 10:00 am-6:00 pm, Sun. 10:00 am-5:00 pm; Adults $2.00, Seniors $1.00, Children are Free; Mineral, fossil, gem, jewelry, geode and used equipment dealers, club member and special exhibits, live demonstrations, concessions stand, silent auction, spin and win and kid's activities, gem flume and outdoor swap; contact Ed Wagner, (309) 838-7782; e-mail: loesseditor@gmail.com; Web site: Facebook us

# ON THE ROCKS

by BOB JONES

## The Dallas Mineral Symposium

Last August, I attended the Dallas Mineral Collecting Symposium. It was the third time I'd experienced this wonderful educational event in Texas. The 2015 Dallas Mineral Collecting Symposium is being held Aug. 21-23.

The beauty of the Dallas Symposium, aside from the marvelously informative lectures, are the supportive activities, thanks to local organizations that participate in the event.

The weekend really starts on Friday night when The Arkenstone, a noted mineral business in the Dallas area, opens its gallery doors and hosts a wonderful evening for collectors and dealers. We socialize and talk about minerals while getting the latest news on mineral finds and activities in the mineral world. It is amazing how much I learn in such a setting. For instance, I learned that my friend Julian Gray, a former curator of the Weinman Mineral Museum in Charlottsville, Georgia, is now Director of one of my favorite museums, the Rice Northwest Museum of Rocks and Minerals.

At the 2014 Symposium, I particularly enjoyed meeting two *Rock & Gem* readers who had decided to come for the weekend because of what I'd written about the Symposium. I knew from their reaction that they thoroughly enjoyed the entire event.

The Symposium itself is held at Texas Christian University. There are excellent morning refreshments and a wonderful lunch in the middle of the lecture series. Regular breaks allow participants time to digest the lectures and talk about them. Eight superb lectures are held on Saturday, with the program ending around 5 p.m. That gives folks time to enjoy a leisurely meal in Dallas, after which they take in the amazing exhibits at the Perot Museum of Nature and Science during an evening open house. What a way to top off a superb mineral event!


**Evan Jones described the amazing, world-class azurites found at the Milpillas mine in Mexico. (Unique Minerals specimen)**

You can read more about the Perot Museum in my two-part article "The Perot Museum of Nature and Science" (January and February 2014). The Perot Museum has gained great notice for its amazing display of minerals, but these superb specimens do not actually belong to the museum. They are on loan from a host of local mineral collections, and specimens are rotated on a regular basis. This ensures that visitors will see something new almost every time they go.

The museum displays include a number of what I would call "old classics"—Kongsberg silver, English fluorite and hematite, and Franklin, New Jersey, fluorescent calcite and willemite—as well as choice, recently mined specimens of exceptional quality. Not to be outdone by The Arkenstone as a host, the Perot Museum provided a tasty selection of treats and a [no host] bar. I must admit, my diet really took a beating there and at the Perot, thanks to their tempting dessert bars!

I gleaned some great information from last year's superb symposium presentations. It is hard to select which of the eight lectures I thought most stimulating. They were all superb, but Dr. Robert Hazen got the symposium off to a thunderous start with his lecture "The Great Oxidation Event: Diversity of Colorful Mineral Species". He gave us wonderful insights into how all the colorful secondary minerals like azurite, smithsonite, malachite, diotase, cuprite form. I recommend you read Dr. Hazen's superb book, *The Story of Earth* (Penguin Books, 2013). In it he develops in detail the evolution of oxygen-bearing species to their present-day abundance.

A second lecture I was particularly impressed with was given by Dr. David Mustart, Professor of Geology at San Francisco State University. Titled "Origin of Precious Metal Deposits: Mines that Produce

**The first Dallas Mineral Collector Symposium I attended featured speaker Harrison Schmitt, the only geologist to walk on the moon.**

World-Class Collectible Specimens", it described how famous precious metal deposits developed. It made me want to grab my pick and metal detector and go field collecting.

In his lecture, Mustart gave life to the continental drift theory and plate tectonics. He described their role in bringing us just a few critically important precious metal deposits, including Cobalt, Canada, Kongsberg, Norway, the California gold fields, and the Transylvania area of Romania. I'll never pick up another gold specimen without thanking Dr. Mustart for his insights on how that piece of precious metal arrived in my hand!

Two speakers treated specific mineral localities we all enjoy: the Red Cloud mine in Arizona, famous for its wulfenite, and the Milipillas mine in Mexico, known for azurite. Two other speakers addressed topics related to Dr. Mustart's talk: the monster gold nuggets of Australia and the silver mines of Mexico. The latter lecture was given by my friend Dr. Peter Megaw. I worked with Pete on the Tucson Gem and Mineral Show® committee for a couple of decades, so I know his expertise. He has been successful in developing several small, but rich, silver deposits in Mexico and did a wonderful job of explaining the why and how of Mexico's silver riches.

For years, I theorized that the great silver mines of Mexico had developed from black smokers along a plate boundary because they are aligned in a nearly straight linear arrangement. Pete, however, explained how plate tectonics and subduction of the Pacific Ocean plates created the conditions for rich silver deposits to develop in Mexico. I found this a most fascinating lecture as I had been in several of the larger silver mines he described.

Tony Frazer did a great job of bringing to light many of Australia's famous monster gold nuggets in his talk "Gold Fever: Monster Gold Nuggets of Victoria's Golden Triangle". Starting with the amazing Welcome Stranger nugget, Tony described a host of huge Australian gold pieces found mainly by digging, but also by using metal detectors. Any rockhound with a metal detector who heard Tony's talk would have boarded a plane for Australia, fired up to find the next "big one".

Les Presmyk's talk on the Red Cloud mine would make any mineral collector who owned one of these wulfenites go home and hug their specimen. His talk "Red Cloud: The World's Greatest Wulfenite Locality" convinced just about everyone at the symposium that the Red Cloud mine wulfenite really is special.

I've known Les since his teenage years. We belong to the same mineral groups, so I have a great deal of respect for him. Before Les gave his talk, I was thoroughly convinced that the bright-orange wulfenite and red mimetite specimens from the San Francisco mine at Cucurpe (Sonora), Mexico, were the world's best. Having collected in both localities, I am still not totally sure he's right, but I'm Welsh and stubborn!

What can I say about the talk entitled "The Milpillas Mine, Sonora, Mexico: A Modern Bonanza"? After all, my son Evan gave the talk, so I have to say it was the best of the day. Seriously, it was a very informative and well-organized talk. This mine has produced azurites that rival—and in some cases surpass—anything from Bisbee or Tsumeb. Evan showed a large selection of these blue beauties after describing in some detail the geology of the deposit.

Seven years ago, Milpillas began producing velvet malachite and malachite pseudomorphs after azurite. Then the azurite bonanza hit the market and people lusted after these amazingly lustrous crystal beauties. Evan, thanks to his ability to speak some Spanish and his connections near the mine, was able to handle a lot of the azurite and world-class brochantite that came from Milpillas.

Unfortunately, due to illness, my friend Dr. Bob Cook was unable to attend to give his talk, "Gold Rush: Crystallized Gold Specimens from Classic California Localities", but Dr. Gene Meieran gave the talk and did a great job. Gene has played a significant role through the last several years in helping make this symposium a winner! Gene can speak extemporaneously on a host of topics, giving the symposium plenty of backup.

The most invigorating talk of the day was presented by Dr. James Horan, who wowed the audience with his stirring presentation of "Thumbnail Specimens: Little Treasures Collecting and Competing". Jim is a skilled speaker and he clarified much of the motivation and the focus behind collecting thumbnails, at which some collectors look askance. He had the group laughing and nodding enthusiastically about thumbnails by the time he was done.

Now we can look forward to the 2015 Dallas Mineral Collecting Symposium! I wouldn't miss it. The lineup of speakers is as impressive as in past years. Every reader will want to attend the 2015 Symposium because the focus is on minerals from Africa!

The lineup of speakers and their topics has me anticipating a great August weekend:

Brice Gobin, who risks his life to bring minerals out of Africa, will give a stirring talk called "Tanzanite: From Mine to Market". Speaking on Tsumeb, Namibia, will be Dr. Robert Bowell. We all have specimens from this "Mineralogical Paradise", as Bob calls it. Lately, Madagascar has yielded amazing mineral species, and Dr. Fedrerico Pezotta will bring us up to speed on this mineral-rich island. My friend Tom Gressman, with whom I've spent time in China, will describe the wonderful magazine *The Mineralogical Record*, which has featured so many fine articles on Africa.

**This remarkable gold nugget was discovered with a metal detector and is displayed at the Perot Museum.**

From South Africa, Dr. Bruce Cairncross will describe the amazing manganese fields in the Kalahari Desert, the source of so many astounding rhodochrosite specimens and of purple gem sugilite. Bruce has written a couple of very informative texts on the manganese fields and is a great addition to the speaker lineup.

Tomek Prazkier will take us on "Adventures in Morocco, Featuring Mibladen". Specimens of vanadinite, wulfenite, and other minerals from this vast African nation are in almost everyone's collection, and this talk will make them more meaningful.

To close out the 2015 symposium, Dr. Cairncross and Dr. Bowell will combine to bring us "Darkest Africa: Classic and Contemporary Copper Minerals and News from Africa". The copper and uranium minerals from Africa are colorful and abundant.

If you missed the 2014 Dallas Mineral Collecting Symposium, you can obtain a superbly done DVD by BlueCap Productions at bluecapproductions.com. There is a wonderful selection of DVDs about other major shows, well-known mines, and mineral events. I even host some of the work. There's still time to register for the symposium at www.dallassymposium.org/2015-symposium/. I consider the fee very reasonable for what you get. I hope to see you there!

Bob Jones holds the Carnegie Mineralogical Award, is a member of the Rockhound Hall of Fame, and has been writing for *Rock & Gem* since its inception. He lectures about minerals, and has written several books and video scripts.

# PARTING SHOT

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